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SELECTED WATER RESOURCES ABSTRACTS

VOLUME 4, NUMBER 8
APRIL 15, 1971

W71-03851 -- W71-04350

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WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center,
Office of Water Resources Research, U.S. Department of the Interior

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As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States—now and in the future.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifiers which are listed in the **Water Resources Thesaurus** (November 1966 edition). Each abstract entry is classified into ten fields and sixty groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

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Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

Additional "centers of competence" have been established in cooperation with the Environmental Protection Agency. A directory of the Centers appears on inside back cover.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Resources Research and other Federal water resources agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangements of this bulletin are welcome.

Water Resources Scientific Information Center
Office of Water Resources Research
U.S. Department of the Interior
Washington, D. C. 20240

CONTENTS

FOREWORD_____iii

SUBJECT FIELDS AND GROUPS

(Use Edge Index on back cover to Locate Subject Fields and Indexes in the journal.)

01 NATURE OF WATER
Includes the following Groups: Properties; Aqueous Solutions and Suspensions

02 WATER CYCLE
Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

03 WATER SUPPLY AUGMENTATION AND CONSERVATION
Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

04 WATER QUANTITY MANAGEMENT AND CONTROL
Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Non-Water Activities; Watershed Protection.

05 WATER QUALITY MANAGEMENT AND PROTECTION
Includes the following Groups: Identification of Pollutants; Sources of Pollution; Effects of Pollution; Waste Treatment Processes; Ultimate Disposal of Wastes; Water Treatment and Quality Alteration; Water Quality Control.

06 WATER RESOURCES PLANNING
Includes the following Groups: Techniques of Planning; Evaluation Process; Cost Allocation, Cost Sharing, Pricing/Repayment; Water Demand; Water Law and Institutions; Nonstructural Alternatives; Ecologic Impact of Water Development.

07 RESOURCES DATA
Includes the following Groups: Network Design; Data Acquisition; Evaluation, Processing and Publication.

08 ENGINEERING WORKS
Includes the following Groups: Structures; Hydraulics; Hydraulic Machinery; Soil Mechanics; Rock Mechanics and Geology; Concrete; Materials; Rapid Excavation; Fisheries Engineering.

09 MANPOWER, GRANTS, AND FACILITIES
Includes the following Groups: Education—Extramural; Education—In-House; Research Facilities; Grants, Contracts, and Research Act Allotments.

10 SCIENTIFIC AND TECHNICAL INFORMATION
Includes the following Groups: Acquisition and Processing; Reference and Retrieval; Secondary Publication and Distribution; Specialized Information Center Services; Translations; Preparation of Reviews.

SUBJECT INDEX

AUTHOR INDEX

ORGANIZATIONAL INDEX

ACCESSION NUMBER INDEX

ABSTRACT SOURCES

SELECTED WATER RESOURCES ABSTRACTS

01. NATURE OF WATER

1B. Aqueous Solutions and Suspensions

DENTISTRY PROFESSOR EXPLAINS POLYWATER.
Chemical and Engineering News, Vol 49, No 3, p 7, January 18, 1971. 1 p, 3 photo.

Descriptors: *Aqueous solutions, *Capillary action, *Diffusivity, *Ion transport, Analytical techniques, Surface tension, Nucleation, Water vapor, Quartz, Solvents.
Identifiers: *Polywater, Isocaps.

Capillary phenomena that affect the behavior of many liquids may explain the peculiar behavior of polywater, according to materials scientist and dentistry professor William J. O'Brien of the Michigan University dental school. The dissolving power of liquids is intensified billions of times when their vapors condense in microscopic capillaries. As a result, the condensing vapors extract normally insoluble ions from the capillary walls. This could account for the high concentrations of impurities found by some workers in their preparations of polywater. In developing equations to describe liquid behavior in isocaps, surface tension of water in a very thin isocap was found to be 700 dyne per cm, about 10 times normal. This high surface tension hinders nucleation and prevents vapors from condensing by the usual method. Since the drive to condense is very strong, the dissolving power of condensing vapor extracts ions from the capillary walls. High-purity quartz contains enough impurities to account for the ions found in polywater condensed from triple-distilled water. The slow process involves diffusion of ions through the glass to the interface. (Lang-USGS)
W71-03926

STRUCTURE OF WATER IN MICROEMULSIONS: ELECTRICAL, BIREFRINGENCE, AND NUCLEAR MAGNETIC RESONANCE STUDIES,
Florida Univ., Gainesville. Dept. of Chemical Engineering; and Florida Univ., Gainesville. Dept. of Anesthesiology.
Dinesh O. Shah, and Roy M. Hamlin, Jr.
Science, Vol 171, No 3970, p 483-485, February 5, 1971. 3 p, 2 fig, 14 ref. FWQA Grant WP 15080 EMP.

Descriptors: *Microenvironment, *Water structure, *Oil-water interfaces, *X-ray analysis, Emulsions, Molecular structure, Electrical resistance, Optical properties, Oily water, Chemical properties, Potassium, Analytical techniques.
Identifiers: *Microemulsions, Water-oil dispersions, Emulsified water.

Microemulsions, which are optically transparent oil-water dispersions, were produced by mixing hexadecane, hexanol, potassium oleate, and water. As the amount of water is increased, the microemulsion exhibits a clear to turbid to clear transition. In contrast to the clear regions, the turbid region possesses birefringence. The development of birefringence is also accompanied by a sharp decrease in the electrical resistance. The high-resolution (220 megacycle) nuclear magnetic resonance data suggest that water exists in two distinct molecular environments in the birefringent region; the first environment is characterized by relatively less mobile water molecules than oil molecules, whereas in the second environment oil molecules are less mobile than water molecules. The electrical, birefringence, and nuclear magnetic resonance data are in agreement with the proposed mechanism of change in the structure of water from water spheres to water cyclinders to water lamellae. The chemical shift of water protons suggests that the molecular environment of water in spheres is different from that of water in cylinders or that of water in lamellae. (Lang-USGS)
W71-04108

THEORETICAL MEAN ACTIVITY COEFFICIENTS OF STRONG ELECTROLYTES IN AQUEOUS SOLUTIONS FROM 0 TO 100 DEG C,
National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.
Walter J. Hamer.
For sale by Superintendent of Documents U.S. Government Printing Office, Washington, D.C. 20402. Price $4.25. National Bureau of Standards Reference Data Series NSRDS-NB24, December 1968. 271 p, 135 tab, 28 ref. NASA Contract R-09-022-029.

Descriptors: *Electrolytes, *Aqueous solutions, *Water chemistry, *Water properties, *Chemical potential, Ionization, Chemical properties, Ions, Data collections, Water quality.
Identifiers: *Activity coefficients (Electrolytes).

Values are tabulated for activity coefficients of electrolytes of various valence types, from 0 to 100 deg C, and for ionic strengths from zero to 0.1 molal or 0.1 molar, as calculated by seven different equations based on the theory of interionic attraction. These equations are those of Debye and Hueckel, Guentelberg, Davies, Scatchard, and Bjerrum, and what may be termed an extended Guentelberg equation and an extended Scatchard equation. (Knapp-USGS)
W71-04183

THE USE OF AMALGAM ELECTRODES TO MEASURE ACTIVITY COEFFICIENTS IN MULTICOMPONENT SALT SOLUTIONS,
Tyco Labs., Inc., Waltham, Mass.
James N. Butler, John C. Synnott, and Rima Huston.
For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. Price $1.00. Office of Saline Water Research and Development Progress Report No 606, October 1970. 109 p, 33 tab, 14 fig, 84 ref. OSW Contract 14-01-0001-607.

Descriptors: *Aqueous solutions, Saline water systems, *Desalination, Thermodynamics, Electrolytes, *Electrodes.
Identifiers: Activity coefficient, *Amalgam electrodes.

Research which has been carried out at this laboratory on activity coefficient measurements using amalgam electrodes, glass electrodes, liquid ion-exchange electrodes, and solid state membrane electrodes is briefly reviewed, and the advantages and limitations of each of these methods are discussed. As a primary standard, amalgam electrode measurements are important because of our detailed knowledge of mechanism. Glass electrode measurements give quite accurate activity coefficient data for some systems, but in others show systematic errors which are not yet fully understood. At the present state of the art, liquid ion-exchange electrodes are not extremely stable or selective, but solid state membrane electrodes promise to be superior in both respects, and may provide the possibility of measurements in systems which otherwise could not be studied. (McCoy-Office of Saline Water)
W71-04221

02. WATER CYCLE

2A. General

ANALYSIS OF STOCHASTIC HYDROLOGIC SYSTEMS,
Illinois Univ., Urbana.
Ven Te Chow, and S. J. Kareliotis.
Water Resources Research, Vol 6, No 6, p 1569-1582, December 1970. 14 p, 8 fig, 16 ref. OWRR Project B-038-ILL (1).

Descriptors: *Stochastic processes, *Mathematical studies, *Mathematical models, Systems analysis, Rainfall-runoff relationships, Statistical methods, Probability, Synthetic hydrology, Regression analysis, Statistical models, Time series analysis.
Identifiers: *Stochastic hydrologic systems.

Hydrologic phenomena are in reality stochastic in nature; that is, their behavior changes with the time in accordance with the law of probability as well as with the sequential relationship between the occurrences of the phenonmenon. To analyze the hydrologic phenomenon, a mathematical model of the stochastic hydrologic system to simulate the phenomenon must be formulated. In this study, a watershed is treated as the stochastic hydrologic system whose components of precipitation, runoff, storage, and evapotranspiration are simulated as stochastic processes by time series models to be determined by correlograms and spectral analysis. The hydrologic system model is then formulated on the basis of the principle of conservation of mass and composed of the component stochastic processes. To demonstrate the practical application of the method of analysis so developed, the upper Sangamon River basin above Monticello in east central Illinois is used as the sample watershed. The watershed system model so formulated can be employed to generate stochastic streamflows for practical use in the analysis of water resources systems. (Knapp-USGS)
W71-03869

THE RELATIONSHIP BETWEEN SUMMER LOW FLOWS AND GEOLOGY IN NORTHLAND, NEW ZEALAND,
Ministry of Works, Wellington (New Zealand). Water and Soil Div.
J. R. Waugh.
New Zealand Ministry of Works, Water and Soil Division Miscellaneous Hydrological Publication No 6, 1970. 21 p, 15 fig, 7 tab, 25 ref.

Descriptors: *Rainfall-runoff relationships, *Streamflow, *Low flow, *Hydrogeology, *Subsurface runoff, Hydrologic data, Foreign projects, Gaging stations, Data collections, Runoff, Discharge measurement, Aquifer characteristics, Water yield, Rivers, Flow rates, Rainfall, Hydrographs, Droughts, Streamflow forecasting.
Identifiers: *New Zealand, Northland (New Zealand), Low-flow data.

Flow data from catchments with uniform geology in Northland, New Zealand are used to show that the geology of the catchment area is the most important influence on the low flows. Fifteen catchments, each on a single rock type, were selected for stream gaging. Later, towards the end of the drought, individual measurements were made at other sites to extend the data for mapping purposes. Chart and punched-tape records from five representative basins and one experimental basin also were collected. It was concluded that: 1. The geology of the catchment area is the main influence on the low flows occurring during a drought. 2. The two, three, and four-monthly rainfall totals for drought periods can be used to allocate an approximate frequency to a particular drought. However, the gaging data available from 1962 and 1968 indicated that antecedent rainfall should also be taken into account in allocating a frequency to a drought. 3. The bulk of the 1968 data available for Northland shows that the concept of using representative basins is quite sound, at least for low-flow data. 4. Catchments in the Waipoua and Whangerei regions (basalt and greywacke rocks) have the greatest potential for future water-supply schemes. (Woodard-USGS)
W71-03931

ANALYSIS OF THE RELATION BETWEEN PRECIPITATION AND FLOOD FLOW WITH THE AID OF A TRIPLE TRANSFORMATION BASED ON THE UNIT HYDROGRAPH METHOD (FRENCH),
Transdanubian Water Authority, Szekesehervar (Hungary). Water Management.
G. Bukovszky, and I. Zsuffa.

In: Floods and Their Computation, Vol 1, International Association of Scientific Hydrology Publication No 84 (Unesco-WMO), p 408-419, 1969. 12 p, 4 fig, 13 ref.

Descriptors: *Rainfall-runoff relationships, *Unit hydrographs, *Flood forecasting, Hydrograph analysis, Mathematical studies, Hydraulics, Stream gages, Runoff forecasting.
Identifiers: Hungary.

Direct methods for establishing the unit hydrograph from any observed hyetograph and its corresponding hydrograph are described. The basic difficulty lies in establishing the relationship between total rainfall and runoff. Transition from the relation of precipitation amount--peak discharge at the outlet of the basin is executed in three successive phases: precipitation amount--effective rainfall, surface runoff--runoff concentration, channel flow--peak discharge at the outlet. The approximation is performed on the basis of direct measurements and hydraulic considerations or by way of experiments or by mathematical methods. (Knapp-USGS)
W71-03980

COMPUTATION OF MAXIMUM STORM DISCHARGE OF MOUNTAIN RIVERS,
Akademiya Nauk Armyanskoi SSR, Erevan; and Ministry of Reclamation and Water Economy, Erevan (USSR). Water Problems and Hydrotechnics Research Inst.
I. V. Eguiazarov, and M. V. Tsovyan.
In: Floods and Their Computation, Vol 1, International Association of Scientific Hydrology Publication No 84 (Unesco-WMO), p 396-403, 1969. 8 p, 1 fig, 2 tab, 6 ref.

Descriptors: *Rainfall-runoff relationships, *Frequency analysis, *High water mark, *Flood forecasting, Hydrograph analysis, Peak discharge, Hydrographs.
Identifiers: *USSR.

The lack of necessary field information on storm runoff, particularly pertaining to small mountain rivers, does not permit determination of the design values of maximum discharges on the basis of direct observations for the majority of streams. This leads to the use of flood discharge determination by flood marks. The frequency of flood discharge is determined on the basis of frequency of effective precipitation, or by the period during which one more flood of the same intensity was observed; synthetic flood hydrographs are computed according to the isochrone method. Using the corrected values of runoff coefficients and the transition coefficients from the given frequency to the design frequency one can plot the design runoff hydrograph of the required frequency. (Knapp-USGS)
W71-03982

EVALUATION OF MAXIMUM FLOW OF FLOODS USING PRECIPITATION DATA (FRENCH),
Grenoble Univ. (France).
M. Parde.
In: Floods and Their Computation, Vol 1, International Association of Scientific Hydrology Publication No 84 (Unesco-WMO), p 379-390, 1969. 12 p.

Descriptors: *Rainfall-runoff relationships, *Peak discharge, *Flood forecasting, Data processing, Statistical methods, Runoff forecasting, Depth-area-duration analysis, Unit hydrographs, Hydrograph analysis.
Identifiers: Rainfall floods.

It is possible, by means of precipitation data, to determine the maximum discharges in past floods, or to control and, if necessary, to correct numerical data on floods. Estimation of the peak-flood discharge is recommended as a function of the total liquid volumes compatible with coefficients established for each basin for calculating flood runoff and duration. Interrelations of flood runoff, maximum discharge, and rainfall are duration. The same methods can be used for the estimation of floods caused by exceptional rainstorms. (Knapp-USGS)
W71-03983

FORMATION OF RAINFALL FLOODS ON SMALL WATERSHEDS. PRINCIPLES OF MAXIMUM STORM RUNOFF COMPUTATION,
Vsesoyuznyi Nauchno—Issledovatelskii Institut Vodosnabzheniya, Kanalizatsii, Gidrotekhnicheskikh Sooruzhenii i Inzhenernoi Gidrogeologii, Moscow (USSR); and Khabarovsk Inst. of Railway Engineers (USSR).
I. L. Zimont, and U. G. Suprunov.
In: Floods and Their Computation, Vol 1, International Association of Scientific Hydrology Publication No 84 (Unesco-WMO), p 321-329, 1969. 9 p, 3 fig, 1 photo, 9 ref.

Descriptors: *Rainfall-runoff relationships, *Flood forecasting, Hydraulic similitude, Dimensional analysis, Model studies, Hydrograph analysis, Hydraulic models, Simulated rainfall.
Identifiers: Watershed models.

A description of experiments on flood formation in field and laboratory conditions is presented. On the basis of the theory of similitude and the dimensionality method, modelling conditions are suggested, which may be used for flood prediction on small basins. A method is suggested which allows plotting outline of the hydrograph for the experimental basin if data on precipitation are available. (Knapp-USGS)
W71-03988

CALCULATION OF THE MAXIMUM RUNOFF IN FLOODS FROM RAINFALL OVER THE TERRITORIES OF THE UKRAINE AND MOLDAVIA (WITH NO OR INSUFFICIENT HYDROMETRICAL DATA),
Ukrainskii Nauchno-Issledovatelskii Gidrometeorologicheskii Institut, Kiev (USSR).
P. F. Wishnevsky.
In: Floods and Their Computation, Vol 1, International Association of Scientific Hydrology Publication No 84 (Unesco-WMO), p 483-492, 1969. 10 p, 1 fig.

Descriptors: *Rainfall-runoff relationships, *Depth-area-duration analysis, *Routing, *Runoff forecasting, Water yield, Rainfall intensity, Flood plains, Probability, Flood forecasting.
Identifiers: USSR.

Available observation records of Ukrainian rainfall and runoff were used to design a method of maximum flood runoff calculation. For the calculation of maximum discharges a formula is suggested, which considers basic components of the runoff formation mechanism, including the value and duration of water yield and time lag. L0cal specific features of basins are taken into consideration. The calculation parameters of the formula are worked out on the basis of observations available. Reduction of the maximum runoff is considered according to the time lag. For the calculation of flood runoff volumes, two types of relationship are worked out for mountain and plain territories. (Knapp-USGS)
W71-03991

THE WORLD OF WATER,
Minnesota Univ., Minneapolis. Water Resources Research Center.
William Clarence Walton.
New York, NY, Taplinger Publishing Company, 1970. 318 p, 3 fig, 25 plate, 42 ref.

Descriptors: *Water resources, *Reviews, *Earth (Planet), *Hydrologic cycle, *Hydrology, Surface waters, Groundwater, Atmosphere, Water properties, Precipitation (Atmospheric), Evapotranspiration, Meteorology, Climatology, Oceans, Currents (Water), Tides, Waves (Water), Temperature, Water chemistry, Soil moisture, Aquifers, Lakes, Swamps, Reservoirs, Streams, Flood control, Water supply, Sewage, Dams, Recreation, Wildlife, Water conservation, Planning, Management, Synoptic analysis.

An attempt is made to present, in nontechnical language, a digest of facts to inform the intelligent general reader about water and its relation to everday life. The information presented has been largely abstracted from the references listed at the end of the book. The oceans, ice caps, glaciers, subsurface reservoirs, lakes, swamps, surface reservoirs, streams, and atmosphere contain the earth's total water. The physical aspects of these subjects are reviewed in this book together with biological, recreational, wildlife, economic, legal, and social aspects. Some of the measures taken by man to develop and manage water resources and the effects of man's activities on the environment are discussed. The problem of water conservation is stressed. (Woodard-USGS)
W71-04118

ISOTOPE HYDROLOGY, 1970.
International Atomic Energy Agency, Vienna (Austria).

Proceedings Symposium of International Atomic Energy Agency and UNESCO, Vienna, March 9-13, 1970: Vienna, International Atomic Energy Agency STI/PUB/255, 1970. 918 p.

Descriptors: *Tracers, *Radioactivity techniques, *Radioactive dating, *Radioisotopes, *Hydrogeology, Water balance, Sedimentation, Sedimentology, Conferences, Hydrology, Groundwater movement, Surface waters, Estuaries, Hydrologic cycle, International Hydrological Decade.
Identifiers: *International Atomic Energy Agency.

The Third Symposium on the Use of Isotopes in Hydrology, which took place in Vienna on 9-13 March 1970, was organized by the International Atomic Energy Agency in cooperation with the United Nations Educational, Scientific and Cultural Organization. The development of isotope hydrology, which is a useful tool for practicing hydrologists, has an interdisciplinary history. The early work was done by isotope specialists. As the various techniques evolved, hydrologists became interested in its potential. At the symposium there was a balance between these two types of workers, which indicates that the research has developed into practical working methods. The determination of groundwater parameters for a growing population, and the sedimentation of harbors and rivers are two of the major problems discussed at the symposium. The 59 papers presented in 9 sessions: environmental isotopes in the water cycle; carbon-14 dating of groundwater; field use of environmental isotope methods; tracer studies of surface waters; sediment studies; borehole techniques and nuclear instruments; canal and reservoir leakage; computation; and new techniques in tracing and dating. (See also W71-04134 thru W71-04142) (Knapp-USGS)
W71-04133

DISTRIBUTION OF HYDROGEN ISOTOPES IN CANADIAN WATERS,
Atomic Energy of Canada Ltd., Chalk River (Ontario). Chalk River Nuclear Labs.
R. M. Brown.
In: Isotope Hydrology, 1970, Proceedings Symposium of International Atomic Energy Agency and UNESCO, Vienna, March 9-13, 1970: Vienna, International Atomic Energy Agency STI/PUB/255, Paper No SM-129/1, p 3-21, 1970. 19 p, 12 fig, 3 tab, 9 ref.

Descriptors: *Deuterium, *Tritium, *Tracers, *Tracking techniques, *Synoptic analysis, Climatology, Water sources, Weather patterns,

Meteorology, Precipitation (Atmospheric), Storms, Streamflow, Lakes, Evapotranspiration, Fallout, Distribution patterns.
Identifiers: *Canada, *Hydrogen isotope distribution (Canada).

The passage of bomb tritium through natural water systems in Canada has been followed since 1954. Recently the distribution of deuterium in precipitation and surface waters has been studied. These data give valuable information on the continental water cycle and the turnover characteristics of individual river basins. Tritium and deuterium concentrations vary inversely in natural waters. Low concentrations of tritium and high concentrations of deuterium occur in coastal regions which receive the first condensate from oceanic vapor. As the moisture moves inland, it picks up more tritium from the atmosphere and is depleted in deuterium by preferential condensation of HDO. This pattern is particularly marked in northern and western Canada where low temperatures and mountain barriers across the weather tracks from the Pacific reduce the deuterium content of the limited amount of moisture reaching central Canada. In the east, absence of mountain barriers across weather tracks from the Gulf of Mexico results in the relatively high deuterium concentrations in southern Ontario and Quebec. Storm-to-storm fluctuations in isotope content of precipitation at Ottawa reflect a variability in the origin of precipitating moisture. Seasonal variation of tritium, due to late spring feed-in from the stratosphere, has been particularly prominent and regular at Canadian latitudes. Declining annual peak concentrations since 1963 indicate depletion of the stratospheric reservoir with a half-time of 1.2 years. (See also W71-04133) (Knapp-USGS)
W71-04134

VARIATION OF THE TRITIUM AND OXYGEN-18 CONTENT IN PRECIPITATION AND SNOWPACK IN A REPRESENTATIVE BASIN IN CZECHOSLOVAKIA,
International Atomic Energy Agency, Vienna (Austria); and Hydraulic Research Inst., Prague (Czechoslovakia).
T. Dincer, J. Martinec, B. R. Payne, and C. K. Yen.
In: Isotope Hydrology, 1970, Proceedings Symposium of International Atomic Energy Agency and UNESCO, Vienna, March 9-13, 1970: Vienna, International Atomic Energy Agency STI/PUB/255, Paper No SM-129/3, p 23-42, 1970. 20 p, 13 fig, 6 tab, 6 ref.

Descriptors: *Tritium, *Oxygen, *Snowpacks, *Snowmelt, *Tracers, Melt water, Precipitation (Atmospheric), Altitude, Water balance, Heat budget, Hydrologic budget, Evaporation, Melting, Percolation, Porous media, Runoff.
Identifiers: *Oxygen isotopes, *Czechoslovakia.

Variation of the tritium and oxygen-18 content of the precipitation and the snowpack during the winter of 1965-1966 and the following snowmelt season was studied in a small mountain basin in northern Czechoslovakia. A significant altitude effect exists for oxygen-18 when the precipitation is not in the solid form. Evolution of the isotopic composition of the snowpack reflects the movement of meltwater in the snowpack and its relation to the thermal conditions in the snowpack. Early snowmelt percolates through the snowpack without much mixing with the snow matrix. At the middle of the snowmelt period the meltwater mixes with the water in the lower layers during the percolation of the water through the snowpack. A pseudo-altitude effect is observed in the snowpack due to the disappearance of the isotopically light early winter snow from the lower altitudes which are subject to intermittent melting during the winter months. (See also W71-04133) (Knapp-USGS)
W71-04135

DEUTERIUM MEASUREMENTS ON SNOW SAMPLES FROM THE ALPS,
Gesellschaft fuer Strahlenforschung m.b.H., Munich (West Germany). Institut fuer Radiohydrometrie.
H. Moser, and W. Stichler.
In: Isotope Hydrology, 1970, Proceedings Symposium of International Atomic Energy Agency and UNESCO, Vienna, March 9-13, 1970: Vienna, International Atomic Energy Agency STI/PUB/255, Paper No SM-129/4, p 43-57, 1970. 15 p, 11 fig, 2 tab, 7 ref.

Descriptors: *Deuterium, *Snowpacks, *Altitude, *Distribution patterns, Snowmelt, Melt water, Precipitation (Atmospheric), Water balance, Hydrologic budget, Evaporation, Melting, Runoff, Tracers, Rainfall.
Identifiers: *Switzerland, *Alps.

Measurements of the deuterium content of snow samples from different regions of the western and eastern Alps revealed a general difference between samples of fresh snow and pack snow. The deuterium content of fresh snow was found to decrease approximately linearly with increase in elevation. The variation was about -4 parts per thousand per 100 m rise in elevation, and the deuterium content corresponded to that measured for rain in Central Europe. Pack snow, on the other hand, showed an increase in deuterium content with rise in elevation which, for the samples examined, fell within about ..5 parts per thousand per 100 m rise in elevation. Natural snow samples were used to follow and interpret the variation with time of the deuterium content caused by the aging of the snow. In addition to the dependence of the deuterium content on elevation, the annual pattern of the deterium content of snow samples corresponds to the known curve for deuterium in precipitation. (See also W71-04133) (Knapp-USGS)
W71-04136

EXCHANGE OF DEUTERIUM BETWEEN ICE AND WATER IN GLACIOLOGICAL STUDIES IN ICELAND,
Iceland Univ., Reykjavik. Science Inst.
B. Arnason.
In: Isotope Hydrology, 1970, Proceedings Symposium of International Atomic Energy Agency and UNESCO, Vienna, March 9-13, 1970: Vienna, International Atomic Energy Agency STI/PUB/255, Paper No SM-129/5, p 59-71, 1970. 13 p, 6 fig, 1 tab, 17 ref.

Descriptors: *Deuterium, *Glaciers, *Regimen, *Melting, *Melt water, Ice, Cryology, Climatology, Hydrologic budget, Water balance, Radioactive dating, Movement, Paleoclimatology, Precipitation (Atmospheric), Altitude, Water sources.
Identifiers: *Iceland, *Iceland ice cap.

The annual variation of deuterium concentration in precipitation in Iceland is small. This makes it possible to estimate the mean annual deuterium concentration in the precipitation on Icelandic glaciers by collecting samples of the winter layer before the beginning of the melting season. Ice cores collected from several boreholes on the glaciers, ranging in depths up to more than 100 m, were analyzed for their deuterium content. Extensive homogenization, which takes place in the uppermost winter layer during summer thaws, may be ascribed to an isotope exchange between ice and water in temperate glaciers. In the autumn, the deuterium concentrations in ice and water approach isotopic equilibrium at least up to an altitude of 1300 m. The isotope ratio can therefore be used for estimating the runoff ratio. This ratio, together with measurements of the amount of retained precipitation in previous annual layers, gives the amount of total yearly precipitation on temperate glaciers. The results are in good agreement with available data obtained independently. At an altitude of 2000 m deuterium measurements show that the yearly precipitation is totally accumulated. Therefore, at this altitude the deuterium concentration of an ice core collected by drilling through the ice cap may reflect the past climatic changes as o-18 does on polar glaciers. Small variations in the mean annual temperature are reflected in variations of the deuterium concentration of the ice core. (See also W71-04133) (Knapp-USGS)
W71-04137

WATER MOVEMENT IN THE UNSATURATED ZONE OF HIGH AND LOW PERMEABILITY STRATA BY MEASURING NATURAL TRITIUM,
Atomic Energy Research Establishment, Wantage (England). Research Lab.; Water Resources Board, Reading (England); and Hydrological Research Unit, Wallingford (England).
D. B. Smith, P. L. Wearn, H. J. Richards, and P. C. Rowe.
In: Isotope Hydrology, 1970, Proceedings Symposium of International Atomic Energy Agency and UNESCO, Vienna, March 9-13, 1970: Vienna, International Atomic Energy Agency STI/PUB/255, Paper No SM-129/6, p 73-87, 1970. 15 p, 6 fig, 7 ref.

Descriptors: *Groundwater movement, *Soil water movement, *Recharge, *Tracers, *Tritium, Unsaturated flow, Percolation, Limestones, Clays, Porous media, Tracking techniques, Model studies, Rainfall-runoff relationships, Surface-groundwater relationships, Distribution patterns, Rainfall, Precipitation (Atmospheric), Water balance, Evapotranspiration.
Identifiers: *England, Chalk.

Measurement of the natural tritium concentration in groundwater samples from a vertical profile in the unsaturated zone of a formation provides information on the downward movement of water in the strata. The tritium profiles are evaluated in terms of hydrological models to examine the mechanism of water recharge. Tritium measurements in the Chalk of England show that downward movement is principally by intergranular seepage with a smaller component of movement through crack systems. Two hydrological models offer alternative interpretation of the water recharge. Tritium measurements in a low-permeability clay show the downward movement of water by intergranular seepage and indicate that recharge occurs by replenishment of the summer soil moisture deficit by autumn rainfall. (See also W71-04133) (Knapp-USGS)
W71-04138

QUANTITATIVE ASPECTS OF THE STUDY OF WATER BALANCES IN LAKES USING THE DEUTERIUM AND OXYGEN-18 CONCENTRATIONS IN THE WATER, (FRENCH),
Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
Liliane Merlivat.
In: Isotope Hydrology, 1970, Proceedings Symposium of International Atomic Energy Agency and UNESCO, Vienna, March 9-13, 1970: Vienna, International Atomic Energy Agency STI/PUB/255, Paper No SM-129/7, p 89-107, 1970. 19 p, 9 fig, 2 tab, 14 ref.

Descriptors: *Water balance, *Lakes, *Deuterium, *Oxygen, Limnology, Tracers, Tracking techniques, Evaporation, Precipitation (Atmospheric), Recharge, Discharge (Water), Water sources, Water circulation, Diffusion, Mixing, Model studies, Hydraulic models, Mass transfer, Advection.
Identifiers: France, *Oxygen isotopes.

Water in a reservoir which is subjected to relatively strong evaporation has an O-18 content different from that of its recharge water. The processes responsible for the modification of the isotopic composition of the water in a reservoir in relation to its recharge water are summarized. In the proposed O-18 diagram both deuterium and O-18 give the same information and measuring both should indicate the accuracy of the method. The measurable quantity is the ratio between evapora-

tion and recharge. The numerical value of this ratio closely depends on the water vapor transport equation used in the diagram, in particular the relation between the evaporation rate and the diffusion coefficient. Measurements of evaporation in a tunnel under laminar flow conditions are described in some detail. Under these flow conditions the mass transport equations are well known and can be solved numerically by computers. The evaporation rate and the related isotope effects in given experimental conditions can then be calculated exactly. The extent to which the results obtained with deuterium and oxygen-18 depend on the hypotheses that have to be made in the absence of complete knowledge of all the parameters. (See also W71-04133) (Knapp-USGS)
W71-04139

ENVIRONMENTAL ISOTOPE BALANCE OF LAKE TIBERIAS,
Weizmann Inst. of Science, Rehovoth (Israel).
J. R. Gat.
In: Isotope Hydrology, 1970, Proceedings Symposium of International Atomic Energy Agency and UNESCO, Vienna, March 9-13, 1970: Vienna, International Atomic Energy Agency STI/PUB/255, Paper No SM-129/8, p 109-127, 1970. 19 p, 11 fig, 21 ref.

Descriptors: *Water balance, *Lakes, *Deuterium, *Oxygen, Limnology, Tracers, Tracking techniques, Evaporation, Precipitation (Atmospheric), Recharge, Discharge (Water), Water sources, Water circulation, Diffusion, Mixing, Mass transfer, Advection.
Identifiers: *Israel, *Lake Tiberias (Israel).

The stable isotope composition and tritium content of Lake Tiberias (Sea of Galilee or Lake Kinneret) has been monitored for over ten years. The O-18 concentration in the upper water mass undergoes a yearly cycle of average amplitude of 0.5 parts per thousand. The hypolimnion follows the change at much reduced amplitude. Deuterium concentrations change in a similar manner with 5.3 times the variation of O-18. The mean yearly isotope composition shifts up to 1.5 parts per thousand for O-18 as a result of hydrological imbalances between water gain and losses. Detailed balance calculations based on available hydrological and climatic data were made and their reliability discussed. In particular, the effect of vertical stratification and the magnitude of separation coefficients were explored. It is shown that controlled evaporation experiments can give more pertinent data on the exchange fluxes of both tritium and stable isotopes than calculations based on time-averaged humidity data. From such evaporation experiments using thermostatted pans, effective isotope fractionation factors for O-18 and deuterium evaporation were determined and shown to depend on the degree of atmospheric turbulence and the stability in the surface layer. (See also W71-04133) (Knapp-USGS)
W71-04140

STABLE ISOTOPES IN STUDY OF WATER BALANCE OF LAKE NEUSIEDL, AUSTRIA: INVESTIGATION OF THE RELIABILITY OF THE STABLE ISOTOPE METHOD,
Heidelberg Univ. (West Germany). Physikalisches Institut (II).
U. Zimmermann, and D. H. Ehhalt.
In: Isotope Hydrology, 1970, Proceedings Symposium of International Atomic Energy Agency and UNESCO, Vienna, March 9-13, 1970: Vienna, International Atomic Energy Agency STI/PUB/255, Paper No SM-129/9, p 129-138, 1970. 10 p, 2 fig, 2 tab, 13 ref.

Descriptors: *Water balance, *Lakes, *Deuterium, *Oxygen, Limnology, Tracers, Tracking techniques, Evaporation, Evapotranspiration, Precipitation (Atmospheric), Recharge, Discharge (Water), Water sources, Water circulation, Diffusion, Mixing.
Identifiers: *Austria, *Lake Neusiedl (Austria).

The isotopic composition of a lake depends on its water balance; therefore the balance equations of stable isotopes provide information for evaluating the water balance. The main source of error is that of the isotope content of the moisture evaporating from the lake. Errors in the isotope content of the lake water and its variation with time are also important. Stable isotope measurements were used to study the water balance of Lake Neusiedl near Vienna. Since 1965 the isotope content of rain, river water, groundwater, and lake water have been determined. Water vapor has been collected continuously since March 1968. Even where all isotope data are determined with good accuracy, it can be difficult to determine the evaporation rate of a lake with an accuracy better than 50%. (See also W71-04133) (Knapp-USGS)
W71-04141

PERCH LAKE EVAPORATION STUDY,
Atomic Energy of Canada Ltd., Chalk River (Ontario). Chalk River Nuclear Labs.
P. J. Barry, and W. F. Merritt.
In: Isotope Hydrology, 1970, Proceedings Symposium of International Atomic Energy Agency and UNESCO, Vienna, March 9-13, 1970: Vienna, International Atomic Energy Agency STI/PUB/255, Paper No SM-129/10, p 139-151, 1970. 13 p, 3 fig, 1 tab, 2 ref.

Descriptors: *Lakes, *Water balance, *Evaporation, *Tracers, *Tritium, Groundwater movement, Surface-groundwater relationships, Hydrogeology, Trace elements, Energy budget.
Identifiers: *Canada, *Perch Lake (Ontario).

The Perch Lake project used radioactive tracers in the study of all aspects of the hydrological cycle in a small, well-defined basin. The use of tritiated water vapor for the study of evaporation mechanisms in a natural setting is believed to be unique. Other studies include the determination of the water, tritiated water, energy and trace element budgets of the lake of which the first three complement the use of tritiated water vapor to study basic evaporation mechanisms. Radioactive tracers have been used particularly for estimating the groundwater components of the water and tritium budgets. Groundwater flows predicted by the use of conventional hydrological techniques as well as various new flow models are being compared with the results obtained using radioactive tracers. Perch Lake is a small (0.45 sq km) lake on the property of Atomic Energy of Canada Limited at Chalk River, Ontario. It contains about 400 pCi/ml of tritium coming from the liquid disposal area operated by the Chalk River Nuclear Laboratories. Waste solutions containing several thousands of curies of tritium are discharged annually into pits in the ground and then move both in the surface and groundwaters of Perch Lake swamp into the lake. One small creek provides the only outlet for surface water for the whole basin. (See also W71-04133) (Knapp-USGS)
W71-04142

A SIMPLE CASCADE WATERSHED MODEL,
California Univ., Davis. Dept. of Water Science and Engineering.
Jaime Amorocho, and Gary Leroy Guymon.
California University Water Resources Center Report, August 1969. 16 p, 4 fig, 2 tab, 8 ref. OWRR Project B-005-CAL (3).

Descriptors: *Mathematical models, *Simulation analysis, *Rainfall-runoff relationships, Runoff forecasting, Synthetic hydrology, Groundwater movement, Surface-groundwater relationships, Evaporation, Routing.
Identifiers: *Cascade watershed-model.

The applicability of a simple cascade model to a real watershed is examined; the model is composed of a soil water submodel and a linear streamflow routing model cascaded together. The model roughly represents hourly instantaneous watershed outflows. The errors associated with the model can be minimized by further adjustments to the model. The soil water submodel consists of a watershed divisible into a variable number of 3-dimensional zones occupying some unknown space in the watershed. The zones have an ordered effect on the evapotranspiration and runoff process. One rainfall station is used as an index of hourly input to the prototype watershed and daily pan evaporation data is used to estimate hourly evaporation. From these data, the soil water submodel estimates hourly rainfall excess. (Knapp-USGS)
W71-04181

SECULAR VARIATION OF ARIDITY IN THE WORLD,
Tokyo Metropolitan Univ. (Japan). Faculty of Science.
Yoshinari Ambe.
Japanese Journal of Geology and Geography, Vol 38, No 1, p 43-61, 1967. 10 fig, 2 tab, 21 ref.

Descriptors: *Arid lands, *Climatic data, *Precipitation (Atmospheric), *Evaporation, *Climatic zones, Statistical methods, Temperature, Climatology, Seasonal, Data collections, Deserts, Variability, Correlation analysis, Average, Foreign countries, United States, Geographical regions, Mexico, Air circulation, Fluctuation, Distribution patterns, Maps.
Identifiers: *Potential evapotranspiration, *Thorthwaite's formula, *Climatic classification, *Global studies, Continents, Hemispheres, Africa, Asia, Australia, South America.

An attempt is made to understand recent climatic variations from the standpoint of spatial variation of arid climatic regions. Since variations in arid climates seem to reflect secular variations of general circulation, it is important to determine whether recent world climatic variations take place on a global scale, on a hemispheric unit or on a continental scale. Monthly aridity is defined on the basis of the precipitation (P)/evaporation (E) ratio, which corresponds to Thornthwaite's P-E ratio. If the ratio is less than 1 for any month, it is termed a 'dry month'. An arid region is defined as any region in which every month is a dry month. Using precipitation and temperature data from a number of years over the past half century, the P-E ratio was calculated for each month of the year and for all continents except those latitudinal regions where mean monthly temperatures fell below -10 deg. C. All arid region boundaries were then defined, and their variation over time was determined. Climatic conditions forming arid regions varied from year to year, and the variation was always greater on the east side than the west. However, in the period 1931-1960 no remarkable changes with a definite tendency were found. Frequency distributions had generally large variances, indicating complicated arid zone formation factors. In yearly fluctuations hemispheric scale variations predominated over those on a global scale and relationships between climatic variations in the northern and southern hemispheres were insignificant. The large variability in arid region patterns shows the characteristics of climate itself, reflecting conditions of atmospheric circulation. (Casey-Arizona)
W71-04288

2B. Precipitation

CLOUD SEEDING POTENTIALITIES IN LOS ANGELES COUNTY.
North American Weather Consultants, Pasadena, Calif.
For primary bibliographic entry see Field 03B.
W71-03903

WATER SUPPLY OUTLOOK FOR THE WESTERN UNITED STATES, 1970-71 WATER YEAR.
National Weather Service, Silver Spring, Md. Office of Hydrology.

Water Supply Outlook for the Western United States, Department Commerce Publication, Vol 23, No 1, January 1, 1971. 16 p, 3 map, 10 tab.

Descriptors: *Water supply, *Runoff forecasting, *Hydrologic data, *Geographical regions, *United States, Probability, Precipitation (Atmospheric), Statistical methods, Hydrology, Meteorological data, Average flow, Streamflow, Water yield, Reservoir storage, Flood forecasting, Surface waters.
Identifiers: *Runoff forecasting (Western United States), Maximum runoff, Minimum runoff, Average runoff.

Precipitation and snowfall accumulation of known probability as determined by analysis of past records are utilized in the preparation of probability runoff forecasts. The forecasts include an evaluation of the standard error of the prediction model. The forecasts are presented at three levels of probability as follows: 1. Most Probable - That runoff which is expected to occur if precipitation subsequent to the date of forecast is median. 2. Reasonable maximum - That runoff which is expected to occur if precipitation subsequent to the date of forecast is equal to the amount which is exceeded on the average once in ten years. 3. Reasonable Minimum - That runoff which is expected to occur if precipitation subsequent to the date of forecasting is equal to the amount which is exceeded on the average nine out of ten years. The Most Probable forecast for a forecast period is given in thousands of acre-feet and in percent of the 15-year average. The Reasonable Maximum and Reasonable Minimum forecasts are shown in a similar manner. The 15-year average flow for the forecast period for 1953 through 1967 and other related data are included. (Woodard-USGS)
W71-03927

THE CALCULATION OF RAINFALL FROM A HURRICANE,
British Meteorological Office, Bracknell (England).
F. Singleton, and N. C. Helliwell.
In: Floods and Their Computation, Vol 1, International Association of Scientific Hydrology Publication No 84 (Unesco-WMO), p 450-461, 1969. 12 p, 5 fig, 5 tab, 7 ref.

Descriptors: *Rainfall, *Hurricanes, *Estimating, *Probable maximum precipitation, *Probability, Statistical methods, Weather data, Precipitation intensity, Rainfall disposition, Model studies, Mathematical models, Statistical models.
Identifiers: Jamaica, Hurricane rainfall.

Maximum values of point and areal rainfall were computed for a catchment area in Jamaica using an empirical model of a hurricane. The hurricane model used was that derived by the Hydrologic Services Division, United States Weather Bureau. The values resulting from the computation were compared to those obtained using, firstly, a conventional probable maximum precipitation approach involving maximization, and, secondly, the statistical approach of Hershfield. Good agreement was achieved between the three techniques. The method enabled computation of the temporal variation of rainfall during the passage of the theoretical hurricane and also of the effects of variations of speed of movement and in the distance of the hurricane from the catchment. (Knapp-USGS)
W71-03993

A MORE RIGOROUS EXPRESSION FOR THE RATE OF DROPLET GROWTH,
Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
For primary bibliographic entry see Field 03B.
W71-04005

UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME I. STATE-OF-THE-ART OF OCEANOGRAPHIC AND METEOROLOGICAL SENSORS, TUTORIAL DISCUSSION,
Texas Instruments, Inc., Dallas. Services Group.
For primary bibliographic entry see Field 07B.
W71-04009

UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME II. STATE-OF-THE-ART OF OCEANOGRAPHIC AND METEOROLOGICAL SENSORS, CATALOG,
Texas Instruments, Inc., Dallas. Services Group.
For primary bibliographic entry see Field 07B.
W71-04010

UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME III. THE SURVIVAL ENVIRONMENT FOR OCEANOGRAPHIC AND METEOROLOGICAL SENSORS,
Texas Instruments, Inc., Dallas. Services Group.
For primary bibliographic entry see Field 07B.
W71-04011

UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME IV. THE FORMATTING AND TRANSMISSION OF DATA FROM OCEANOGRAPHIC SENSORS,
Texas Instruments, Inc., Dallas. Services Group.
For primary bibliographic entry see Field 07B.
W71-04012

UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME V. ANALYSIS OF APPLYING STANDARDIZATION TECHNIQUES TO OCEANOGRAPHIC SENSORS,
Texas Instruments, Inc., Dallas. Services Group.
For primary bibliographic entry see Field 07B.
W71-04013

UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME VI. TEST REQUIREMENTS FOR OCEANOGRAPHIC AND METEOROLOGICAL SENSORS,
Texas Instruments Inc., Dallas. Services Group.
For primary bibliographic entry see Field 07B.
W71-04014

PREDICTION OF SOLAR AND ATMOSPHERIC RADIATION FOR ENERGY BUDGET STUDIES OF LAKES AND STREAMS,
Florida Univ., Gainsville. Dept. of Environmental Engineering.
W. C. Huber.
Available from NTIS as PB-197 267, $3.00 in paper copy, $0.95 in microfiche. Florida Water Resources Research Center Publication No 10, October, 1970. 128 p, 1 tab, 12 fig, 25 ref, 2 append. OWRR Project A-014-FLA (1).

Descriptors: *Solar radiation, *Radiation, *Energy budget, *Heat budget, Temperature distribution, Hydrologic cycle, Thermal stratification, *Temperature, Lakes, Reservoirs, Thermal radiation, Geothermal studies, Heat balance, Florida, Humidity, Cloud cover, Meteorological data.
Identifiers: Temperature change, Thermal change, Atmospheric radiation, Shortwave radiation, Newman's Lake (Fla), Radiation data.

Evaluation of terms in the energy budget is an integral part of the prediction of thermal changes in natural water bodies. These lakes, reservoirs, streams, and tidal waters receive heat from shortwave solar radiation, longwave atmospheric radiation, and advectively from surface water inflows. The net advective heat flux if often zero, in which case the radiation components are the dominant causes of temperature changes. Predictive methods for the two radiation components have been developed as a function of meteorological parameters alone, (e.g. temperature, humidity, cloudiness, opaqueness). These predictive methods can be used in areas where there are no records of radiation measurements since the required meteorological variables are commonly measured at weather stations and airports. A better predictive equation was found for shortwave radiation than for longwave radiation, due possibly to local climatic conditions and possible errors in portions of the longwave radiation measurements. Use of the shortwave equations in evaluating temporal temperature changes in a Florida lake resulted in good agreement with measured values. A tabulation of 148 days of hourly radiation and meteorological values is included in the report.
W71-04020

OPTIMIZATION FOR PLANNING AND LOCATION OF PRECIPITATION STATIONS IN THE JEMEZ MOUNTAINS,
New Mexico State Univ., University Park. Engineering Experiment Station.
For primary bibliographic entry see Field 06A.
W71-04033

ENVELOPE-FREQUENCY RELATIONS FOR MAXIMUM FLOODS IN MONSOON AREAS OF THE ECAFE REGION.
Economic Commission for Asia and the Far East (UN), New York.

Water Resources Journal, United Nations Economic Commission for Asia and the Far East (ECAFE), p 1-11, June 1970. 11 p, 5 fig, 3 tab.

Descriptors: *Flood forecasting, *Frequency analysis, *Design flood, *Monsoons, *Typhoons, Tropical regions, Wet seasons, Rainfall-runoff relationships, Frequency, Design storm, Warning systems, Peak discharge.
Identifiers: *ECAFE, *Asia.

Of all the factors influencing floods in the ECAFE region, monsoons play the most important role. Design flood envelope curves were determined by fitting a smooth curve through the three outermost points of plotted data. These three controlling points were also used to determine the envelope curve equations for each subregion. In general, the envelope-frequency relations derived in this paper are satisfactory for use by water resources engineers in planning the development of ungaged rivers in the ECAFE region, particularly where data are nonexistent or are inadequate. The most reliable envelopes are those with return periods of 50 years. The 100-year curves are fairly reliable. (Knapp-USGS)
W71-04117

A CONTRIBUTION TO THE PROBLEM OF SPACING RAINGAUGES IN RUGGED TERRAIN,
Otago Univ., Dunedin (New Zealand). Dept. of Geography.
For primary bibliographic entry see Field 07A.
W71-04122

A RAPID METHOD OF COMPUTING AREAL RAINFALL,
Aston Univ., Birmingham (England).
For primary bibliographic entry see Field 07B.
W71-04123

QUANTITATIVE REGIONAL PREDICTION OF RAINFALL IN ECAFE REGIONS,
Meteorological Office, Poona (India).
E. V. Chelam.
In: Forecasting of Heavy Rains and Floods, Proceedings Joint Seminar of Regional Associations 2 and 5 of World Meteorological Organization, Nov 11-23, 1968, Kuala Lumpur, Malaysia, published by World Meteorological Organization, Geneva, p 11-20, 1970. 10 p.

Descriptors: *Weather forecasting, *Synoptic analysis, *Monsoons, *Precipitation (Atmospheric), Atmospheric physics, River forecasting, Wet seasons, Weather patterns, Cloud physics, Meteorology, Floods, Flood forecasting, Fronts (Atmospheric).
Identifiers: *ECAFE, *Asia.

Forecasting of heavy rainfall, with particular reference to quantitative predictions, and with a bearing on the ECAFE region, is discussed. Heavy precipitation is caused by vertical ascent of saturated air. Techniques for assessing and forecasting moisture content and vertical velocity are described, using the concept of precipitable water and the forced ascent of air at an orographic barrier or a dynamic barrier (for example at a frontal surface) or due to horizontal mass convergence. Physical methods of quantitative estimates, statistical techniques employing scatter diagrams, and numerical methods which involve solution of the vertical velocity equation with the aid of an electronic computer are described with special attention given to the applicability of these techniques to the ECAFE region. The synoptic systems which gave heavy rainfall in the region such as depressions, typhoons, convergence zones, mountain waves, etc., are described, and case studies involving applications of the techniques described earlier to these systems are presented. (Knapp-USGS)
W71-04152

VERTICAL VELOCITY AND RAINFALL COMPUTATION,
Meteorological Office, Poona (India).
E. V. Chelam.
In: Forecasting of Heavy Rains and Floods, Proc Joint Seminar of Regional Associations 2 and 5 of World Meteorological Organization, Nov 11-23, 1968, Kuala Lumpur, Malaysia, published by World Meteorological Organization, Geneva, p 21-25, 1970. 5 p, 36 ref.

Descriptors: *Weather forecasting, *Synoptic analysis, *Monsoons, *Precipitation (Atmospheric), Atmospheric physics, River forecasting, Wet seasons, Weather patterns, Cloud physics, Meteorology, Floods, Flood forecasting, Fronts (Atmospheric).
Identifiers: *ECAFE, *Asia.

Formulas used to estimate quantitatively the magnitude of likely rainfall over an area from a vertically ascending mass of saturated air, are reviewed. The basic assumption in many of these attempts is either to ignore the horizontal wind field or treat it as nondivergent. Such an assumption is open to serious objections considering the fact that the observed wind field is seldom nondivergent; moreover, no appreciable vertical velocities (which alone could lead to rainfall) should be expected in a nondivergent wind field. It can be shown that a formula which is substantially of the form as developed by Fulks and Showalter can be derived without recourse to any assumptions about nondivergence of the wind field. The treatment can be easily extended for a case where the air is not fully saturated. In this case, part of the moisture flowing in will go to saturate the moist air and the rest of the excess flow will result in precipitation. The rainfall amounts will then be diminished to the extent of the difference between the unsaturated content of humidity in the air and its saturated value. (Knapp-USGS)
W71-04153

DETECTION OF PRECIPITATION BY RADAR,
Royal Observatory, Hong Kong. Div. of Research and Climatology.
For primary bibliographic entry see Field 07B.
W71-04154

ANALYSIS OF RAINFALL OVER A SMALL AREA,
Royal Observatory, Hong Kong. Div. of Research and Climatology.
P. C. Chin.
In: Forecasting of Heavy Rains and Floods, Proc Joint Seminar of Regional Associations 2 and 5 of World Meteorological Organization, Nov 11-23, 1968, Kuala Lumpur, Malaysia, published by World Meteorological Organization, Geneva, p 44-53, 1970. 10 p, 6 fig, 5 ref.

Descriptors: *Rain gages, *Network design, *Statistical methods, *Rainfall disposition, *Distribution patterns, Reviews, Precipitation intensity, Depth-area-duration analysis, Precipitation (Atmospheric).
Identifiers: *ECAFE, *Asia.

Rainfall in the tropics and subtropics may occur in the form of scattered showers or widespread rain. Forecasts of rain usually depend on the detection of extensive zones of convergence associated with some types of disturbances and on the assumption that the rain is general. The verification of rain occurrence is difficult if the purpose is to distinguish between days on which rain is recorded and those on which no rain occurs. Obviously, a single point of observation over a large area is insufficient. Methods used to obtain an accurate appraisal of the distribution of rainfall and to determine the representativeness of an individual randomly placed rain gage are reviewed. (Knapp-USGS)
W71-04155

RAIN FROM TROPICAL CYCLONES AND TROUGH-TYPE SYSTEMS,
Royal Observatory, Hong Kong. Div. of Research and Climatology.
P. C. Chin.
In: Forecasting of Heavy Rains and Floods, Proc Joint Seminar of Regional Associations 2 and 5 of World Meteorological Organization, Nov 11-23, 1968, Kuala Lumpur, Malaysia, published by World Meteorological Organization, Geneva, p 54-72, 1970. 19 p, 10 fig, 1 tab, 22 ref.

Descriptors: *Synoptic analysis, *Monsoons, Rainfall, Precipitation (Atmospheric), Atmospheric physics, Climatology, Frequency, Frequency analysis, Weather forecasting, Meteorology, Regions, Weather forecasting, Flood forecasting.
Identifiers: *ECAFE, *Asia.

Heavy rainfall over the various regions in Southeast Asia is generally associated with tropical cyclones; monsoon depressions and cyclonic vortices; quasi-stationary or slow-moving fronts, troughs and convergence zones; and easterly or westerly moving troughs or vortices in the upper levels. The primary feature of these disturbances is a relatively extensive area of convergence where local heavy rain, which may be in the form of showers, is embedded in a larger area of 'background' rainfall. It is generally known that rainfall is usually enhanced by the simultaneous presence of surface and upper-air disturbances. Studies in Hong Kong reveal that extreme rains are mostly due to intense convective cells embedded in troughs and in tropical cyclones, so that both types form the controlling systems for this region. (Knapp-USGS)
W71-04156

ANALYSIS OF MESOSCALE SYSTEMS,
Royal Observatory, Hong Kong. Div. of Research and Climatology.
P. C. Chin.
In: Forecasting of Heavy Rains and Floods, Proc Joint Seminar of Regional Associations 2 and 5 of World Meteorological Organization, Nov 11-23, 1968, Kuala Lumpur, Malaysia, published by World Meteorological Organization, Geneva, p 73-90, 1970. 18 p, 8 fig, 1 tab, 13ref.

Descriptors: *Weather forecasting, *Meteorology, *Radar, Synoptic analysis, Weather patterns, Monsoons, Precipitation (Atmospheric), Atmospheric physics, Wet seasons, Floods, Fronts (Atmospheric).
Identifiers: *Mesoscale weather-systems, *ECAFE, *Asia.

The importance of mesoscale features has long been recognized in synoptic studies of cold fronts and thunderstorms. These systems can be identified and followed as entities with good continuity from hour to hour and are associated with most of the severe weather experienced in Southeast Asia. The characteristics of mesosystems are different from those of synoptic systems. In mesosystems, life time is of the order of a few hours and the height-diameter ratio is large. Their flow pattern is characterized by departures from hydrostatic equilibrium. For small-size convective systems, the effect of Coriolis force is relatively unimportant and the feeble entrainment rate would also allow the conventional parcel method to be used to estimate instability, but condensation and evaporation are important from the energy-transfer point of view. In Hong Kong, short-period forecasts of rainfall amount are prepared by analyzing the shape, movement and, whenever possible, the decay characteristics of storm cells as revealed by a 10-cm radar. The data are fed into a small desk-top computer and the expected rainfall at a point for various durations can be computed in a few minutes. (Knapp-USGS)
W71-04157

SURVEY OF OBJECTIVE METHODS USED IN HONG KONG FOR PREDICTING TYPHOON MOVEMENT,
Royal Observatory, Hong Kong. Div. of Research and Climatology.
P. C. Chin.
In: Forecasting of Heavy Rains and Floods, Proc Joint Seminar of Regional Associations 2 and 5 of World Meteorological Organization, Nov 11-23, 1968, Kuala Lumpur, Malaysia, published by World Meteorological Organization, Geneva, p 91-112, 1970. 12 p, 2 fig, 5 tab, 11 ref.

Descriptors: *Typhoons, *Tropical cyclones, *Weather forecasting, Flood forecasting, Atmospheric physics, Forecasting, Synoptic analysis, Weather patterns, Meteorology, Storms.
Identifiers: *Typhoon forecasting, *ECAFE, *Asia.

The development of a reliable system by which typhoon forecasts can be issued early enough for people to take the necessary measures to protect their lives and property is a serious necessity in Southeast Asia and the Tropical Pacific. To satisfy operational needs, the forecast method must provide a good average level of accuracy and should not be unduly dependent on fine detail in the analysis of the basic data. Recent objective techniques for forecasting typhoon movement produce satisfactory results. During 1961, the Hong Kong Royal Observatory initiated a program to test the operational value of several of these techniques. On the whole, the mean errors given by the Veigas-Miller, Tse and persistence climatology methods were found to be less than those given by the nonobjective forecasts of the Observatory. The results given by the persistence climatology method were particularly encouraging. An analysis of the errors associated with individual storms confirmed the previous finding that no method was consistently better for all storms and no method was consistently better for any one storm with a life period of 3 days or more. (Knapp-USGS)
W71-04158

PREDICTION OF FLOODS FROM HEAVY RAINFALL,
Japan Meteorological Agency, Tokyo. Forecast Section.
For primary bibliographic entry see Field 02E.
W71-04159

LECTURE 1 - FACTORS INFLUENCING RAINFALL FORMATION AND DISTRIBUTION,
Bureau of Meteorology, Melbourne (Australia). Service Div.
A. F. Rainbird.
In: Forecasting of Heavy Rains and Floods, Proc Joint Seminar of Regional Associations 2 and 5 of World Meteorological Organization, Nov 11-23,

1968, Kuala Lumpur, Malaysia, published by World Meteorological Organization, Geneva, p 175-182, 1970. 8 p, 5 ref.

Descriptors: *Weather forecasting, *Rainfall, Atmospheric physics, Synoptic analysis, Statistical methods, Cloud physics, Wet seasons, Weather patterns, Meteorology, Precipitation (Atmospheric), Climatology.
Identifiers: *ECAFE, *Asia.

Broad-scale (synoptic scale) and medium-scale (meso-scale) processes which lead to heavy rainfalls are reviewed. Individual rainstorms contribute widely differing amounts of rain. However, the percentage of annual precipitation total supplied by large and small storms appears to be fairly constant irrespective of location of a river basin. Approximately half of the annual precipitation is contributed by about one-quarter of the storms experienced over a basin. Methods in use for making quantitative forecasts of precipitation amount may be classified as: subjective forecasting techniques; statistical techniques; and techniques involving solution of the dynamical equations describing atmospheric motions and the precipitation process. (See also W71-04161 thru W71-04163) (Knapp-USGS)
W71-04160

LECTURE 2 - PROBABLE MAXIMUM PRECIPITATION (PMP) ESTIMATION,
Bureau of Meteorology, Melbourne (Australia). Service Div.
A. F. Rainbird.
In: Forecasting of Heavy Rains and Floods, Proc Joint Seminar of Regional Associations 2 and 5 of World Meteorological Organization, Nov 11-23, 1968, Kuala Lumpur, Malaysia, published by World Meteorological Organization, Geneva, p 183-190, 1970. 8 p, 10 ref.

Descriptors: *Probable maximum precipitation, *Design flood, Estimating, Statistical methods, Model studies, Data collections, Maximum probable flood, Weather data, Weather forecasting, Cloud physics.
Identifiers: *ECAFE, *Asia.

Probable maximum precipitation for a river basin may be estimated by use of: climatological data; storm models; or storm maximization and transposition techniques. Probable maximum precipitation is defined as the largest rainfall that we estimate nature can produce in a specified time over a specified river basin. Time and areal distributions of PMP must also be estimated to allow conversion of rainfall depth to flood discharge. Subjective judgement and experience must be invoked in estimating PMP. No set of objective rules can be specified which, if followed carefully, will lead to a unique answer. The aim of the review paper is therefore to indicate the principles underlying PMP estimation. A routine program of storm rainfall data analysis is strongly recommended. Such a program will provide an invaluable store of analyzed data for future needs in many fields. (See also W71-04160) (Knapp-USGS)
W71-04161

LECTURE 3 - STORM MAXIMIZATION TECHNIQUES IN EQUATORIAL/TROPICAL REGIONS,
Bureau of Meteorology, Melbourne (Australia). Service Div.
A. F. Rainbird.
In: Forecasting of Heavy Rains and Floods, Proc Joint Seminar of Regional Associations 2 and 5 of World Meteorological Organization, Nov 11-23, 1968, Kuala Lumpur, Malaysia, published by World Meteorological Organization, Geneva, p 191-196, 1970. 6 p, 5 ref.

Descriptors: *Probable maximum precipitation, *Design flood, Estimating, Statistical methods, Model studies, Data collections, Maximum probable flood, Weather data, Weather forecasting, Cloud physics.
Identifiers: *ECAFE, *Asia.

The storm moisture adjustment technique has been used extensively in extratropical regions to maximize observed storm rainfalls. However, it is recognized that this technique is not of equal value in all climatic regions of the world, and there are strong limitations to its use in the equatorial/tropical regions. In these regions, very high atmospheric moisture is present for most or all of the time in the rainy season. There is no apparent direct relationship between the minor day-to-day fluctuations observed in atmospheric moisture, and the occurrence of 'normal' wet season rains on one day, and of very heavy rain on another. Two maximization studies for tropical areas are described to illustrate approaches to the special problems posed by these regions. Subjective judgement must be exercised at a number of stages when estimating PMP for a river basin by storm maximization and transposition techniques. Deficiencies in quality or quantity of historical data and uncertainty in applying any of the procedures must be compensated by increased safety margins. (See also W71-04160) (Knapp-USGS)
W71-04162

LECTURE 4 - ESTIMATION OF PMP AND MAXIMUM FLOODS BY STATISTICAL METHODS,
Bureau of Meteorology, Melbourne (Australia). Service Div.
A. F. Rainbird.
In: Forecasting of Heavy Rains and Floods, Proc Joint Seminar of Regional Associations 2 and 5 of World Meteorological Organization, Nov 11-23, 1968, Kuala Lumpur, Malaysia, published by World Meteorological Organization, Geneva, p 197-205, 1970. 9 p, 9 ref.

Descriptors: *Probable maximum precipitation, *Design flood, Estimating, Statistical methods, Model studies, Data collections, Maximum probable flood, Weather data, Weather forecasting, Cloud physics.
Identifiers: *ECAFE, *Asia.

Methods of estimating probable maximum precipitation PMP involve a high degree of subjective judgment and decision. More objective methods of estimating PMP and maximum floods are desirable. The use of techniques in mathematical statistics for these purposes is reviewed. Because statistical methods involve mathematical computation and have the appearance of objectivity, there is a danger that greater confidence may be given to the end results than is really justified. Use of a statistical technique to estimate PMP or a maximum flood involves the assumption that the particular technique used is appropriate and relevant for those purposes. This assumption is usually also based on judgment rather than on mathematical proof. The various estimates derived by different approaches will at least indicate the range of possibilities and will help point to cases where inherent uncertainties justify a conservative approach in project design. (See also W71-04160) (Knapp-USGS)
W71-04163

SEVERE CYCLONIC STORM RESPONSIBLE FOR FLASH FLOOD IN PAKOKKU AND MONYWA DISTRICTS DURING THE MONTH OF OCTOBER 1967,
Burma Meteorological Dept., Rangoon.
Htay Aung.
In: Forecasting of Heavy Rains and Floods, Proc Joint Seminar of Regional Associations 2 and 5 of World Meteorological Organization, Nov 11-23, 1968, Kuala Lumpur, Malaysia; published by World Meteorological Organization, Geneva, p 213-220, 1970. 8 p, 5 fig.

Descriptors: *Floods, *Rainfall-runoff relationships, *Flash floods, Antecedent precipitation, Rainfall intensity, Storms, Cloudbursts, Tropical regions, Tropical cyclones.
Identifiers: *ECAFE, *Burma.

Heavy rains which occurred on October 23-24, 1967 caused a flash flood in the Pakokku and Monywa districts of central Burma. The flash flood and the severe cyclonic storm responsible for the heavy rain are described. Heavy rainfall started on the evening of October 23 and stopped on the morning of October 24. The flash flood thus started on the night of the 23rd and was over on the morning of October 24. The occurrence of the flash flood during the night and the strong winds due to the land depression was unfavorable for evacuation of the inhabitants of Pakokku and Monywa districts. Most of the flash floods in Burma are associated with heavy rainfall. Forecasting of flash floods depends on forecasting of heavy rainfall, which in turn depends on the movement of the storm. (Knapp-USGS)
W71-04164

LOWER AND MIDDLE IRRAWADDY FLOODS IN RELATION TO HEAVY RAINFALL IN THE HEAD WATER REGIONS OF CHINDWIN AND IRRAWADDY RIVERS,
Burma Meteorological Dept., Rangoon.
For primary bibliographic entry see Field 02E.
W71-04165

SOME EXAMPLES OF HEAVY RAINFALL IN JAPAN,
Japan Meteorological Agency, Tokyo.
Yonejiro Yamagishi.
In: Forecasting of Heavy Rains and Floods, Proc Joint Seminar of Regional Associations 2 and 5 of World Meteorological Organization, Nov 11-23, 1968, Kuala Lumpur, Malaysia; published by World Meteorological Organization, Geneva, p 243-252, 1970. 10 p, 3 fig.

Descriptors: *Climatology, *Monsoons, *Synoptic analysis, *Precipitation (Atmospheric), *Typhoons, Tropical cyclones, Storms, Weather forecasting, Meteorology, Atmospheric physics, Wet seasons, Weather patterns, Fronts (Atmospheric), Warning systems.
Identifiers: *Japan, *ECAFE, *Jet streams.

Japan is situated close to the east coast of the Asiatic Continent and is in one of the rainiest areas in the middle latitude. Typhoons attacking Japan from early summer to late autumn bring with them a great quantity of tropical warm moist air, and usually give rise to heavy rainfalls. In early summer, a front remains near and over Japan, while the southwesterly monsoon carries warm moist air from South China to Japan. Almost every year heavy rainfall occurs near this front, particularly in Western Japan. Some characteristic features of heavy rainfall in Japan are discussed in relation to the jet stream pattern. (Knapp-USGS)
W71-04166

THE PROBLEM OF FLOOD PREDICTION ON THE EAST COAST OF WEST MALAYSIA,
Drainage and Irrigation Dept., Kuala Lumpur (Malaysia). Research Station.
Tan Hoe Tim.
In: Forecasting of Heavy Rains and Floods, Proc Joint Seminar of Regional Associations 2 and 5 of World Meteorological Organization, Nov 11-23, 1968, Kuala Lumpur, Malaysia, published by World Meteorological Organization, Geneva, p 253-258, 1970. 6 p.

Descriptors: *Climatology, *Monsoons, *Synoptic analysis, *Precipitation (Atmospheric), *Typhoons, Tropical cyclones, Storms, Weather forecasting, Meteorology, Atmospheric physics, Wet seasons, Weather patterns, Fronts (Atmospheric), Warning systems.
Identifiers: *Malaysia, *ECAFE.

The 1967 floods occurring in the Malaysian east coast States of Kelantan and Trengganu as well as in the State of Perak claimed many victims, and total losses sustained were estimated at some US $12.5 million. A brief description of the storm was given, together with an account of the existing

flood warning system. The seasonal rainfall patterns are associated with two distinct surface winds, namely the N-E and the S-W monsoons - from November to March, and May to September respectively. The most frequent type of monsoon rain is preceeded by strong easterly or northeasterly surface winds in the South China Sea. If it is reinforced by the presence of other low-level atmospheric disturbances in the form of either shallow vortices or strong horizontal winds, then heavy storms covering a large area for an appreciable duration are likely to occur. (Knapp-USGS)
W71-04167

HEAVY RAINFALL IN PAKISTAN AND ITS ASSOCIATED FLOOD,
Pakistan Meteorological Dept., Karachi. Central Secretariat.
M. S. Huq.
In: Forecasting of Heavy Rains and Floods, Proc Joint Seminar of Regional Associations 2 and 5 of World Meteorological Organization, Nov 11-23, 1968, Kuala Lumpur, Malaysia, published by World Meteorological Orgaization, Geneva, p 259-266, 1970. 8 p, 3 fig, 5 ref.

Descriptors: *Climatology, *Monsoons, *Synoptic analysis, *Precipitation (Atmospheric), *Typhoons, Tropical cyclones, Storms, Weather forecasting, Meteorology, Atmospheric physics, Wet seasons, Weather patterns, Fronts (Atmospheric), Warning systems.
Identifiers: *Pakistan, *ECAFE.

Quantitative precipitation forecasting over an area under favorable synoptic conditions is necessary for flood forecasting. Synoptic features of weather systems associated with heavy rainfall over Pakistan during strong southwest monsoon, easterly waves, pre-monsoon, monsoon and post-monsoon depression, western disturbances, and storms are described. Seasonal floods occur over East Pakistan and northern parts of West Pakistan during the southwest monsoon season, when heavy rainfall takes place for days. Flash floods over the northeastern part of West Pakistan during winter result from moderately heavy to heavy rains caused by passage of active western disturbances. Over southern parts of east Pakistan during the period May to October they result from heavy to very heavy rains caused by travel of tropical depression storms over or near the area. Tidal waves occur in East Pakistan when tropical storms cross the coast at the time of high tide. All the formulas reviewed for quantitative precipitation forecasting require use of high-speed electronic computing machines for computation of rainfall. (Knapp-USGS)
W71-04168

HEAVY RAINFALL AND ASSOCIATED FLOODS IN WEST PAKISTAN,
Regional Meteorological Center, Lahore (Pakistan).
Sufi M. Moazzam.
In: Forecasting of Heavy Rains and Floods, Proc Joint Seminar of Regional Associations 2 and 5 of World Meteorological Organization, Nov 11-23, 1968, Kuala Lumpur, Malaysia, published by World Meteorological Organization, Geneva, p 267-281, 1970. 15 p, 10 fig, 1 map.

Descriptors: *Climatology, *Monsoons, *Synoptic analysis, *Precipitation (Atmospheric), *Typhoons, Tropical cyclones, Storms, Weather forecasting, Meteorology, Atmospheric physics, Wet seasons, Weather patterns, Fronts (Atmospheric), Warning systems.
Identifiers: *Pakistan, *ECAFE.

Westerly low-pressure waves, locally known as western disturbances, cause winter rainfall over West Pakistan. Moderately heavy rainfall occurs occasionally due to active low-pressure waves. The summer monsoon is mainly responsible for rainfall over West Pakistan and over the upper catchment areas of the rivers of the Indus Basin. During the monsoon season, depressions and storms developing over the Bay of Bengal and then moving towards West Pakistan cause heavy rainfall over the upper catchment of the rivers and sometimes over the plains as well. Floods are mainly due to this heavy rainfall. Moderately heavy to heavy rainfall in winter over the Indus and Jhelum catchment areas can also cause medium or high floods. Rainfall predictions are made empirically with upper-air and normal seasonal precipitation maps. Rainfall-runoff relationships were evolved for flood forecasting purpose. (Knapp-USGS)
W71-04169

THE CIRCULATION PATTERN OVER SINGAPORE AND THE EAST COAST OF WEST MALAYSIA DURING JANUARY AND FEBRUARY 1967 COMPARED WITH THAT OF JANUARY AND FEBRUARY 1968,
Singapore Meteorological Service.
T. L. Gan.
In: Forecasting of Heavy Rains and Floods, Proc Joint Seminar of Regional Associations 2 and 5 of World Meteorological Organization, Nov 11-23, 1968, Kuala Lumpur, Malaysia, published by World Meteorological Organization, Geneva, p 283-289, 1970. 7 p, 3 fig, 9 ref.

Descriptors: *Climatology, *Monsoons, *Synoptic analysis, *Precipitation (Atmospheric), *Typhoons, Tropical cyclones, Storms, Weather forecasting, Meteorology, Atmospheric physics, Wet seasons, Weather patterns, Fronts (Atmospheric), Warning systems.
Identifiers: *Malaysia, *ECAFE.

In January 1967 there was catastrophic flooding on the east coast of North Malaya, and in February 1967 there was flooding in South Malaya. By contrast January and February 1968 were dry. The well-developed troughs in the sub-tropical jetstream which extended to equatorial latitudes over West Malaysia in January - February 1968, were mainly responsible for the dry weather over Singapore and the east coast of West Malaysia during this period. Heavy rainfall in January - February 1967, was associated with vortices in the inter-tropical convergence zone with a broad deep easterly current to the north. The vortex of January 5, 1967, was associated with a strong surge of the trades and a cold surge from Siberia (indicated by high and increasing pressure over China). It is likely that these two factors intensified the vortex and produced the abnormally heavy rainfall from January 5-6, 1967. (Knapp-USGS)
W71-04170

THE CLIMATE OF INTERIOR OMAN,
Anti-Locust Research Centre, London (England).
D. E. Pedgley.
Meteorological Magazine, Vol 99, No 1171, p 29-37, February 1970. 2 fig, 3 tab, 17 ref.

Descriptors: *Arid lands, *Monsoons, *Precipitation (Atmospheric), *Climatic data, *Winds, Seasonal, Climatology, Meteorology, Turbulence, Temperature, Humidity, Convection, Tropical regions, Tropical cyclones, Advection, Flow profiles.
Identifiers: *Oman, *Intertropical convergence zone, *Oman convergence zone.

Until recently, data on the climate of the interior of Oman and the Empty quarter of Arabia in general, have been lacking. Now, oil company exploration camps are keeping records and some data, though inadequate, is available. Records from Fahud indicate relative humidity maxima occurring January and February and a secondary maximum in August and September. Mean monthly temperature maxima show a seasonal trend, with January the coolest and June the hottest, while July to September were each cooler than expectations from trends in the other months. This is associated with monsoonal blowing from the Arabian Sea during those months. A 7-year rainfall record is adequate, but indicates an annual total of 30 mm, most of which falls from March to May with scanty falls from July to September. These records are similar to those from Midway, Dhofar and Nizwa, although Nizwa, at the eastern base of the Hajar Mountains, experiences somewhat more July to September rainfall. Over the Hajars, annual totals reach 150 mm. The southerly monsoon (July to September), peaks in July and is about 1 km deep. For the rest of the year, dry north-westerlies dominate the interior and when they meet either easterlies (November to January) or Southerlies (February to June, October), an Oman convergence zone is indicated. From July to September this zone becomes the intertropical convergence zone. (Casey-Arizona)
W71-04227

A NEW APPROACH TO THE CLASSIFICATION OF CLIMATE,
Middlebury Coll., Vt. Dept. of Geography.
Vincent H. Malmstrom.
Journal of Geography, Vol 68, No 6, p 351-357, September 1969. 5 fig.

Descriptors: *Climatic zones, *Classification, *Climatic data, *Water balance, *Temperature, Precipitation (Atmospheric), Evapotranspiration, Mosture deficit, Geographic regions, Mapping, Crops, Vegetation, Soil, Estimating equations, Vapor pressure, Monthly, Data collections.
Identifiers: *Potential evapotranspiration, *Climatic types, *Mosture index, *Warmth index, *Thornthwaite climatic classification.

While it represents a conceptual advance over the Koppen system, the Thornthwaite climatic classification is difficult in practice because parameter computations are tedious and their significance is obscure. Proceeding from the fact that saturation vapor pressure, a relative expression, is primarily a function of temperature, a method was devised for determining the 'water need' (N) of any given station by using only the average monthly temperature of that station. This was achieved by finding a threshold value giving a close approximation to the appropriate Thornthwaite potential evapotranspiration value and incorporation of a correction factor. The threshold value empirically decided upon was 25 mm at O deg. C. The water need for a given month may be obtained by dividing the saturation vapor pressure at the monthly temperature by the saturation vapor pressure at O deg. C., and multiplying by 25 mm. Annual water need is the sum of the monthly water needs. Annual precipitation may then be divided by annual water need to obtain a 'moisture index'. The average annual water budget of an area may by assessed by plotting both N and precipitation against time. A 'warmth index' (WI) was developed using a 6 deg. C. threshold value from growing-degree studies, discarding all months where N was less than 38 mm and subtracting 38 mm from all other months. Therefore WI—N-38 mm/100. Thus, for every station 4 parameters are obtained and it is the moisture index and WI that are employed in describing climatic differentiation. Resulting climatic maps using these indices are given and a number of valuable results are obtained and discussed. (Casey-Arizona)
W71-04235

SOME ASPECTS OF DROUGHT CLIMATOLOGY OF THE DRY SUBHUMID ZONES OF SOUTH INDIA,
Andhra Univ., Waltair (India). Dept. of Meteorology and Oceanography.
V. P. Subrahmanyam, and C. V. S. Sastri.
Journal of the Meteorological Society of Japan, Vol 47, No 4, p 239-244, August 1969. 6 fig, 1 tab, 5 ref.

Descriptors: *Subhumid climates, *Droughts, *Water balance, *Climatic data, Precipitation (Atmospheric), Evapotranspiration, Statistical methods, Data collections, Climatology, Arid climates, Humid climates, Variability, Hydrologic cycle, Climatic zones, Fluctuation, Moisture deficit, Semiarid climates.
Identifiers: *Aridity index, *Potential evapotranspiration, *Agroclimatology, *India, *Thornthwaite's equation.

In attempting to evaluate drought, rainfall analysis is insufficient, water budgets alone are capable of yielding objective data. Using Thornthwaite's methods, the dry regions of South India were demarcated into 3 climatic types-dry subhumid, semiarid and arid. Deficiencies of 50% in rainfall in humid or arid climates do not greatly affect water balance. By contrast, drought study in dry subhumid zones is especially interesting because water balances fluctuate so frequently and violently. The aridity index is the ratio of annual water deficiency to total annual water need. Drought intensity is evaluated by the departure of aridity indices from their median. Drought indices were plotted from 4 representative weather stations for the period 1891-1965. Plots of aridity index vs. time showed long-term trends in climatic shifts toward arid or humid. Plots of actual evapotranspiration, potential evaporation and rainfall vs. month give accurate picture of water balance fluctuations over a given year. This data is particularly crucial for agriculture in subhumid zones. (Casey-Arizona)
W71-04298

2C. Snow, Ice, and Frost

INVESTIGATION OF THE WATER REGIME OF SOILS IN THE AERATION ZONE, THEIR FREEZING, WATER-PHYSICAL AND FILTRATION PROPERTIES,
For primary bibliographic entry see Field 02G.
W71-03964

PROBLEM OF THE CLASSIFICATION AND SPATIAL VARIABILITY OF THE ALBEDO OF A HOMOGENEOUS GLACIER SURFACE DURING THE ABLATION PERIOD,
V. G. Konovalov.
Translated from Trudy TSANIGMI, No 44 (59), 1969, p 102-107. Soviet Hydrology: Selected Papers, No 4, p 406-409, 1969. 4 p, 4 tab, 5 ref.

Descriptors: *Estimating, *Glaciers, *Ablation, *Regimen, *Albedo, Statistical methods, Instrumentation, Surveys, Melting, Measurement, Sampling.
Identifiers: *Glacier albedo, USSR.

The results of albedo measurements on different glaciers of the USSR show that despite the natural variability of the average albedo within the same type, the reflectivity of a melting glacier surface can be reasonably well differentiated according to several gradations resulting from a visual estimate of the state of the active surface. The measurements were made mainly in clear and slightly cloudy weather over an area of 1.2 sq km at elevations between 2800 and 3000 m around noon. The points where the albedo was measured were 30-50 m apart and distributed as evenly as possible in the ablation area. The experimental data obtained were used to compute several statistical characteristics. (Knapp-USGS)
W71-03971

SOME FEATURES OF THE MECHANICS OF GLACIER MOVEMENT,
V. A. Litosh.
Translated from Trudy TSANIGMI, No 44 (59), 1969, p 89-98. Soviet Hydrology: Selected Papers, No 4, p 399-405, 1969. 7 p, 1 fig, 18 ref.

Descriptors: *Glaciers, *Rheology, *Movement, Non-Newtonian flow, Viscosity, Plasticity, Mathematical studies, Data collections, Regimen, Physical properties.
Identifiers: *Glacier movement, *USSR.

To solve the plane problem of the movement of an isothermal mountain glacier for a cross section formed by the vertical plane crossing the line of movement near the axis of the glacier, the Fedchenko Glacier, USSR, was selected for study. The lines of the longitudinal profile of the glacier surface are properly approximated by a straight line. An approximation by second-degree polynomials is quite acceptable for the functions of the surface ice velocity, the difference in the mass balance at the surface, and the changes in the level of the glacier surface. The problem was solved by analyzing the process of steady-state creep or nonlinear viscous flow. The initial system of equations was formulated in terms of the stress components. For steady-state creep, the general differential equations in terms of stress include balance equations and continuity equations analogous to the Beltrami-Mitchell equations in elasticity theory. The continuity equations are formed by excluding the rates of deformation by means of rheological equations from the St. Venant compatibility conditions. (Knapp-USGS)
W71-03972

COMPUTATION OF FLOW IN GLACIER-FED RIVERS,
For primary bibliographic entry see Field 02E.
W71-03975

LITERATURE SURVEY OF MOISTURE MIGRATION IN SOILS DUE TO THERMAL GRADIENTS,
Northwestern Univ., Evanston, Ill. Dept. of Civil Engineering.
J. O. Osterberg, and W. N. Fead.
Available from NTIS as AD-711 899, $3.00 in paper copy, $0.95 in microfiche. Special Report 32, Feb 1959. 9 p, 11 ref. Army Contract DA-11-190-ENG-6.
Identifiers: *Soils, Reviews, *Moisture, Soils, Thermal properties, Ice, Permafrost, Surface tension, Vapors, Pressure, Frost heave, Diffusion, Condensation.

The purpose of this study was to discover what work had been done on vapor diffusion in soils, in order to uncover any theory which might explain the occurrence of ice lenses in permafrost.
W71-04000

RECONSTRUCTION OF SUBGLACIAL RELIEF FROM RADIO ECHO SOUNDING RECORDS,
Scott Polar Research Inst., Cambridge (England).
C. H. Harrison.
Geophysics, Vol 35, No 6, p 1099-1115, December 1970. 7 p, 14 fig, 7 ref.

Descriptors: *Remote sensing, *Radar, *Glaciers, *Channel morphology, *Topography, Antarctic, Geomorphology, Movement, Instrumentation, Calibrations, Data collections.
Identifiers: *Subglacial relief, *Radio echo sounding.

In 1967 a party from the Scott Polar Research Institute, Cambridge, England, carried out a radio echo sounding survey of the Antarctic ice sheet. The radio echo sounding apparatus basically a pulse-modulated radar operating at 35 Mhz, was installed in a U. S. Navy Constellation aircraft. The fan-shaped beam is broadest along the line of flight, causing problems of interpretation analogous with those encountered in marine echo sounding and seismic surveying. Also, bottom echoes are affected by refraction at the ice surface. Examples of hyperbolic variations of echo delay with horizontal movement may be seen at the edges of ice shelves, crevasses, or cracks at the bottom of the ice. It is possible to distinguish specular from nonspecular reflections; the shape of the reflecting surface may be calculated. A computer program transforms the digitized film record into a real space profile. A cross-section of Nimrod Glacier and the bottom of the ice sheet near Vostok were plotted; in both cases there is a striking difference between the computed space profile and the echo profile. (Knapp-USGS)
W71-04112

DEUTERIUM MEASUREMENTS ON SNOW SAMPLES FROM THE ALPS,
Gesellschaft fuer Strahlenforschung m.b.H., Munich (West Germany). Institut fuer Radiohydrometrie.
For primary bibliographic entry see Field 02A.
W71-04136

EXCHANGE OF DEUTERIUM BETWEEN ICE AND WATER IN GLACIOLOGICAL STUDIES IN ICELAND,
Iceland Univ., Reykjavik. Science Inst.
For primary bibliographic entry see Field 02A.
W71-04137

SNOWMELT AND WATER YIELD FROM SNOW COVER,
State Hydrological Inst., Leningrad (USSR).
P. P. Kuzmin.
In: Floods and Their Computation, Vol 2, International Association of Scientific Hydrology Publication No 85 (Unesco-WMO), p 591-598, 1969. 8 p, 1 fig, 1 tab, 2 ref.

Descriptors: *Snowmelt, *Flood forecasting, *Streamflow forecasting, Water balance, Heat budget, Water yield, Snowpacks, Snow surveys, Meteorology, Statistical methods, Frequency analysis.
Identifiers: Snowmelt forecasting.

Research methods of assessing snowmelt and water yield from snow cover to provide data for analysis of spring flood formation and runoff calculation are discussed. The main parameters of snowmelt and water yield are mean water equivalent of snow cover and its areal distribution up to the beginning of the snowmelt period, hourly and daily variations of snowmelt intensity, characteristic snowmelt dates and stages, and rate of water yield from snow cover. To determine mean water equivalent of snow cover, snow surveys based on periodical statistical sampling are performed; distribution (frequency) curves of water equivalent of snow cover are plotted. To determine snowmelt and rate of water yield, methods are based on consideration of components of the heat and water balance of the snow cover, as well as an empirical formula using standard meteorological observations from the hydrometeorological network. Water yield from snow cover is derived from the water balance equation. (Knapp-USGS)
W71-04171

A METHOD FOR THE COMPUTATION OF WATER YIELD FROM SNOW DURING SNOWMELT PERIOD,
State Hydrological Inst., Leningrad (USSR).
A. G. Kovzel.
In: Floods and Their Computation, Vol 2, International Association of Scientific Hydrology Publication No 85 (Unesco-WMO), p 598-607, 1969. 10 p, 2 fig, 2 tab, 7 ref.

Descriptors: *Water yield, *Snowmelt, *Streamflow forecasting, Water balance, Heat budget, Snowpacks, Snow surveys, Meteorology, Statistical methods.
Identifiers: Snowmelt forecasting.

Computation of water yield from snow involves the transformation of snowmelt water and rainfall by the snow pack on the surface of the watershed for any time interval of the whole snowmelt period. The scheme is applied to detailed investigation of runoff formation by snowmelt on watersheds as modified by the influences of physiography and man's activity. Snowmelt intensity is computed by the method of heat budget of the snow pack, or by means of simpler computation schemes based on the application of standard meteorological observation data. To characterize the snow cover distribution over a watershed, the mass curve of water equivalent distribution should be used. Tables permit computation of the outflow of snowmelt water from the snow pack on the surface of the basin at

two of the most common indices of the water-holding capacity of snow. The method also provides a means of estimation of the total area of the basin free from snow for any moment during the snowmelt period without using direct measurements. (Knapp-USGS)
W71-04172

SOME PROBLEMS OF DETERMINING THE WATER EQUIVALENT OF THE SNOW COVER,
Research Inst. for Water Resources Development, Budapest (Hungary).
M. Hegedus, and K. Szesztay.
In: Floods and Their Computation, Vol 2, International Association of Scientific Hydrology Publication No 85 (Unesco-WMO), p 616-628, 1969. 13 p, 8 fig, 3 ref.

Descriptors: *Snow surveys, *Runoff forecasting, *Water equivalent, Snowpacks, Snowmelt, Streamflow forecasting, Flood forecasting, Sampling, Monitoring, Gaging stations, Water yield.
Identifiers: *Hungary.

During recent years 52 stations and 2 experimental areas have been installed in the framework of preliminary investigations for elaborating a Hungarian national program for snow measurement. The first results of these measurements are evaluated. The following problems are discussed: the conditions of equal accuracy in snow depth and water equivalent measurements; the real accuracy in determining snow density from depth and water equivalent data; factors affecting variability of simultaneous snow depth and density values along snow courses and within small areas; and theoretical bases of planning a combined application of snow depth and snow density measurements. (Knapp-USGS)
W71-04173

SOME RESULTS OF INVESTIGATION AND REPRESENTATION OF SNOW SUPPLY AND THE MELTING OF SNOW,
Meteorologischer Dienst der Deutschen Demokratisches Republik, Halle. Amt fuer Meteorologie.
M. Rachner.
In: Floods and Their Computation, Vol 2, International Association of Scientific Hydrology Publication No 85 (Unesco-WMO), p 628-637, 1969. 10 p, 7 fig, 11 ref.

Descriptors: *Snowmelt, *Water yield, *Snowpacks, *Meteorology, *Energy budget, Streamflow forecasting, Water supply, Ablation, Snow surveys, Water equivalent.
Identifiers: Snowmelt forecasting.

Results of experiments to investigate and represent the snow-supply and the ablation of snow cover for the Selke catchment area, German Democratic Republic are presented. Methods of surveying snow cover are outlined. The ablation of snow cover is calculated by the aid of radiation measurements and the energy budget. Special measurements (gradients of climatic elements) showed significant local differences of snow-cover ablation. The importance of the experiments with regard to water management and hydrology is discussed. (Knapp-USGS)
W71-04174

RUNOFF CONDITIONS DURING SNOW THAWING IN THE MORAVIAN-SILESIAN BESKIDS,
Research Inst. of Amelioration, Prague (Czechoslovakia).
V. Zeleny.
In: Floods and Their Computation, Vol 2, International Association of Scientific Hydrology Publication No 85 (Unesco-WMO), p 637-644, 1969. 8 p, 8 tab, 5 ref.

Descriptors: *Snowmelt, *Floods, *Water yield, Snowpacks, Flood forecasting, Streamflow forecasting, Data collections, Hydrologic data, Runoff, Runoff forecasting.
Identifiers: Czechoslovakia.

Among the causes of floods is snowmelt. Using the examples of runoff during the thawing in the experimental watersheds Mala Raztoka and Cervik in the Moravian-Silesian Beskids it is shown that in these mountain forested regions the thawing of snow is usually quite harmless because of the configuration of the landscape and of the presence of forests. In the course of 13 years there has not been a single case recorded of any flood wave with a maximum runoff above 367 liters/sec/sq km. (Knapp-USGS)
W71-04175

METHODS OF SNOWMELT MAXIMUM DISCHARGE COMPUTATION IN CASES OF ABSENCE OR INSUFFICIENCY OF HYDROMETRIC DATA,
State Hydrological Inst., Leningrad (USSR).
A. A. Sokolov.
In: Floods and Their Computation, Vol 2, International Association of Scientific Hydrology Publication No 85 (Unesco-WMO), p 671-680, 1969. 10 p, 2 fig, 2 tab, 12 ref.

Descriptors: *Runoff forecasting, *Streamflow forecasting, *Snowmelt, *Flood forecasting, *Gaging stations, Statistical methods, Peak discharge, Topography, Climatology, Meteorology, Vegetation effects, Frequency analysis, Synoptic analysis.
Identifiers: USSR.

Investigations were performed to verify existing computation formulas on the basis of long period observations of 2300 stations in the USSR and to establish the most reasonable estimation scheme of snow melt maximum discharges in cases of absence or insufficiency of hydrometric data. The proposed estimation scheme is based on the depth of spring flood runoff and the reduction of the coefficient of runoff intensity (ratio of maximum specific discharge to the total depth of spring flood runoff) depending on catchment area. The principal parameters of the scheme are the coefficient of runoff intensity and the reduction parameter; they are assumed to be variables and are determined on empirical data for each natural zone. Rivers of mountain regions are considered separately. The estimation scheme takes into account individual basin features affecting snowmelt maximum runoff such as: lake percentage and distribution over the basin; swamp percentage and swamp characteristics; forest percentage and relief and soil characteristics of the basin. (Knapp-USGS)
W71-04177

A METHOD FOR THE CALCULATION OF SPRING FLOODS,
Ukrainskii Nauchno-Issledovatelskii Gidrometeorologicheskii Institut, Kiev (USSR).
For primary bibliographic entry see Field 02E.
W71-04178

ANALYSIS OF SNOW MELT FLOODS,
Public Works Research Inst., Tokyo (Japan).
For primary bibliographic entry see Field 02E.
W71-04179

ESTIMATION OF THE WATER SUPPLY FROM SNOW COVER IN THE SOUTHERN PART OF THE GERMAN D. R. IN SPRING 1965,
Meteorologischer Dienst der Deutschen Demokratischen Republik, Berlin. Forschungsinstitut fuer Hydrometeorologie.
H. Grasnick.
In: Floods and Their Computation, Vol 2, International Association of Scientific Hydrology Publication No 85 (Unesco-WMO), p 607-615, 1969. 9 p, 4 fig, 3 tab, 6 ref.

Descriptors: *Snowmelt, *Water yield, *Streamflow forecasting, *Snow surveys, Snowpacks, Water supply, Flood forecasting, Statistical methods, Meteorology.
Identifiers: Snowmelt forecasting.

The extreme snow conditions in the German Democratic Republic in the beginning of March 1965 caused a problem of evaluation of the water supply to be expected from a large snow-covered area. By means of an ad hoc snow survey it was possible to appraise the situation in flood-developing territories and to plot maps (scale 1:500,000). By evaluating these maps in terms of snow depth and density, the mean areal value of water supply for several river basins was calculated. The values obtained by various methods gave good agreement. Correlations were found concerning dependence of the water supply on the altitude, but no relation between snow density and altitude. (Knapp-USGS)
W71-04180

THE HYDROLOGY OF SAGEBRUSH LANDS AND THE MANAGEMENT OF BLOWING SNOW,
Forest Service (USDA), Laramie, Wyo. Rocky Mountain Forest and Range Experiment Station.
For primary bibliographic entry see Field 03B.
W71-04248

SUMMARY OF SNOW RESEARCH BY THE ROCKY MOUNTAIN FOREST AND RANGE EXPERIMENT STATION AT LARAMIE, WYOMING.,
Forest Service (USDA), Laramie, Wyo. Rocky Mountain Forest and Range Experiment Station.
Ronald D. Tabler.
Proceedings of the Workshop on Snow and Ice Hydrology, Colorado State University, p 134-135, August 18-22, 1969.

Descriptors: *Research facilities, *Snow management, Sagebrush, Snowpacks, Water yield improvement, Soil-water-plant relationships, Wyoming.
Identifiers: *Snow fences, Blowing snow.

This paper summarizes research conducted by the Rocky Mountain Forest and Range Experiment Station on snow movement and the management of snow on Wyoming's windswept plains. One area of research centers on the use of snow fences to increase usable water yield or to augment moisture available for on-site use. Snow accumulation and melt are also being studied as part of a program to determine the hydrologic characteristics of sagebrush (Artemisia L.) lands and to evaluate the effects of current sagebrush control programs to improve forage values on western rangelands. (Tabler-Forest Service)
W71-04249

SOIL FREEZING DETERMINED WITH FOUR TYPES OF WATER-FILLED TUBES,
Forest Service (USDA), Ogden, Utah. Intermountain Forest and Range Experiment Station.
For primary bibliographic entry see Field 07B.
W71-04251

ARTILLERY CONTROL OF AVALANCHES ALONG MOUNTAIN HIGHWAYS,
Forest Service (USDA), Fort Collins, Colo. Rocky Mountain Forest and Range Experiment Station.
Noel C. Gardner, and Arthur Judson.
USDA Forest Service Research Paper RM-61, 1970. 26 p, 1 tab.

Descriptors: *Snow, *Avalanches, Explosives, Highways, Snow management, Snow pack.
Identifiers: *Avalanche control, Avalanche forecasting, Artillery.

Presents planning and operational procedures, and discusses criteria for avalanche control and the evaluation of avalanche hazard based on field data.

Outlines a method for determining when gunfire should commence. Gives basic information necessary for formulating operational forecasts for highway maintenance and avalanche control personnel based on: mountain weather forecasts, traffic density, and current snow conditions. Explains instrument needs in detail. (Judson-Forest Service)
W71-04258

2D. Evaporation and Transpiration

INFLUENCE OF LOW RATES OF WATER APPLICATION BY SPRINKLERS ON THE MICROCLIMATE,
South Dakota State Univ., Brookings. Dept. of Agricultural Engineering.
John L. Wiersma.
Available from NTIS as PB-197 112, $3.00 in paper copy, $0.95 in microfiche. South Dakota State University Water Resources Center Project Completion Report for July 1965-June 1968. December 1970. 84 p, 12 fig, 27 ref. OWRR Project No. A-006-S Dak (1).

Descriptors: *Sprinkler irrigation, *Irrigation efficiency, *Evapotranspiration, *Water loss, *Crop response, Irrigation design, Irrigation operation and maintenance, Irrigation practices, Soil-water-plant relationships, Microclimatology.
Identifiers: *Low-rate sprinkler irrigation.

An analysis was made of water losses due to evaporation within the wetted area of a low application rate sprinkler system operating during daylight hours under conditions of slight to moderate breezes. The magnitude of evaporation loss from the sprinkled area was determined by measuring the absolute humidity, temperature, and wind speed profiles immediately upwind and downwind from a large bromus grass field where near-horizontal homogeneity existed prior to operation of the sprinkler. Sprinkler discharge rate and operating pressure had minimal effect on water loss. The losses were mainly evaporation from plant surfaces, and were as high as one-half of the sprinkler water discharge. The greatest decrease in evapotranspiration was adjacent to the wetted area. A field 70 meters downwind from the sprinkler line was unaffected. Approximately one-eighth of the water that evaporated within the sprinkled area was offset by a decrease in evapotranspiration in the first 70 meters downwind. The rate of water application had minor effects on the water application efficiency. Irrigation design efficiency should not be substantially affected if application rates are reduced for cost efficiency. (Knapp-USGS)
W71-03925

IMPROVING EFFICIENCY IN AGRICULTURAL WATER USE,
Colorado State Univ., Fort Collins. Natural Resources Center.
For primary bibliographic entry see Field 03C.
W71-04049

AGROMETEOROLOGY SURVEY OF THE HIGHLANDS OF EASTERN AFRICA,
L. H. Brown, and J. Cocheme.
Nature and Resources, Vol 6, No 3, p 2-10, September 1970. 5 fig, 2 tab.

Descriptors: *Evapotranspiration, *Crops, *Climatic data, *Rainfall, *Regional analysis, Grasses, Temperature, Ecosystems, Fungi, On-site investigations, Crop response, Water balance, Environmental effects, Semiarid climates, Tropical regions, Data collections, Soil properties, Agriculture, Seasonal, Plant growth, Monthly, Water requirements.
Identifiers: *East Africa, *Agroclimatology, *Potential evapotranspiration, *Penman's formula, Coffee, Tef, Pyrethrum, Tea.

An eastern Africa highland region including parts of Kenya, Uganda, Tanzania, and Ethiopia was surveyed for climatic factors influencing crop production. The climatic needs and tolerances of various regional crops were also determined and the 2 sets of data were compared so that agriculture in the area would achieve maximum crop production efficiency. Meteorological data from 35 stations were used for calculation of potential evapotranspiration according to Penman's formula. Circular monthly maps of rainfall and potential evapotranspiration were constructed for various areas and the water requirements of given crops could be superimposed upon the maps to determine how closely they matched the water balance of the area. Four crops--Coffee (ccoffea arabica), tef (Eragrostis tef), pyrethrum (Chrysanthemum cinerareifolium) and tea (Camellia sinensis) -- are reviewed with respect to growth requirements, tolerances and optimal cultivation conditions. (Casey-Arizona)
W71-04062

POTENTIAL EVAPOTRANSPIRATION AND THE WATER BALANCE IN WEST AFRICA; AN ALTERNATIVE METHOD OF PENMAN,
California Univ., Los Angeles. Dept. of Geography.
Oyediran Ojo.
Archiv fur Meteorologie, Geophysik und Bioklimatologie, Series B, Vol 17, No 2-3, p 239-260, 1969. 10 fig, 28 ref.

Descriptors: *Evapotranspiration, *Water balance, *Vegetation, *Regional analysis, *Climatic data, Precipitation (Atmospheric), Deserts, Arid lands, Temperature, Humidity, Seasonal, Turbulence, Advection, Convection, Grasslands, Evaporation pans, Energy budget, Heat balance, Biogeography, Winds, Solar radiation, Weather patterns, Theoretical analysis, Estimating equations, Statistical methods, Gradation, Climatic zones, Rainfall, Air masses, Field capacity, Soil moisture, Soil types, Plant groupings, Forests, Stations, Maps, Measurement, Data collections.
Identifiers: *Potential evapotranspiration, *West Africa, *Psychrometers, *Bowen ratio, *Aerodynamic components, Inter-tropical convergence zone, Net radiation, Formulae.

A number of methods of calculating potential evapotranspiration (PE) are reviewed with respect to their applicability to West African climates. Since gradient measurements are difficult and complicated by advection in arid areas, Penman's formula, utilizing an aerodynamic component and an energy component, is preferable. The net radiation term is more important than the aerodynamic term and will therefore be the major source of error in calculated evaporation values. This term was modified using ordinary meteorological parameters. Linear relationships were found between measured values of evaporation using a Piche evaporimeter and calculated values from the original and modified formulae and the aerodynamic term. PE isolines were mapped for West Africa in different seasons. Water balance is the difference between precipitation (P) and PE and P-PE isolines were plotted for different months. Annual water balances were then compared with 10 vegetation zones. The forest-samanna boundary is delimited by P-PE-O and the savanna-desert boundary by P-PE- -3000 mm. Interpretations are sometimes difficult because of modification or degradation of vegetation zones. The data seem to justify use of this empirical formula for agricultural planning, but justification for many of the assumptions awaits the introduction of more sophisticated measuring devices. (Casey-Arizona)
W71-04063

PERCH LAKE EVAPORATION STUDY,
Atomic Energy of Canada Ltd., Chalk River (Ontario). Chalk River Nuclear Labs.
For primary bibliographic entry see Field 02A.
W71-04142

PROBLEMS OF DETERMINING EVAPOTRANSPIRATION IN THE SEMI-ARID TROPICS ILLUSTRATED WITH REFERENCE TO THE SUDAN,
J. Oliver.
Journal of Tropical Geography, Vol 20, No 1, p 64-74, June 1969. 4 fig, 3 tab, 31 ref.

Descriptors: *Evapotranspiration, *Rainfall, *Vegetation, *Semiarid climates, *Water balance, Climatic data, Climatic zones, Vegetation effects, Soil texture, Soil structure, Runoff, Infiltration, Distribution patterns, Diurnal, Ecosystems, Slopes, Arid lands, Tripical regions, Advection, Irrigation effects, Xerophytes, Water vapor, Maps, Sands, Clays, Temperature, Soil temperature, Solar radiation, Energy budget, Topography, Permeability, Rainfall disposition, Evaporation, Winds, Environmental effects, Mode of action, Data analysis, Frequency, Variability.
Identifiers: *Potential evapotranspiration, *Sudan, *Thornthwaite method, *Penman method, *Oasis effect, Plant cover.

In low latitude semiarid areas there is a high level of energy supply so that potential water losses by evaporation and transpiration are large. The 2 main moisture regions of the Sudan are arid and semiarid and a potential evapotranspiration map, a rainfall map and a water deficit map of the country are included. However, in an area with such climatic characteristics, actual evapotranspiration may be considerably different from potential evapotranspiration. Factors responsible for this involve sparse or patchy plant cover resulting in accentuation of the advective 'oasis effect', macro- and microreflief which affect runoff/infiltration ratios, and soil structure and texture which determine infiltration, which in turn affects both runoff and water volume in soil surface layers available for evaporation. Data are given on solar radiation which is a guide to the maximum rate at which rainfall should be lost at the surface. The temporal pattern and extent of rainfall is discussed relative to infiltration and evaporative parameters. In the Sudan there are 2 situations in which actual evapotranspiration will depart from potential evapotranspiration. In unirrigated sparsely vegetated areas, actual losses will be higher than estimates, and in irrigated areas they will be lower than estimates. (Casey-Arizona)
W71-04236

SOIL MOISTURE DEPLETION AND ESTIMATED EVAPOTRANSPIRATION ON UTAH MOUNTAIN WATERSHED,
Forest Service (USDA), Ogden, Utah. Intermountain Forest and Range Experiment Station.
Robert S. Johnston, Ronald K. Tew, and Robert D. Doty.
USDA, Forest Serv Res Paper INT-67, 1969. 13 p, 2 fig, 2 tab.

Descriptors: *Water yield improvement, *Evapotranspiration, *Water loss, *Evapotranspiration control, *Soil water, Soil moisture, Nuclear moisture meters, Soil moisture meters, Oak trees, Forest management, Watershed management, Land management, Water conservation, Vegetation effects, Utah, Mountain forests.
Identifiers: Experimental watersheds, Aspen trees.

Soil moisture depletion was measured with a neutron moisture probe on 14 sites representing 10 vegetation types on mountain watersheds in Utah. A water balance equation was used to estimate evapotranspiration (ET). Both soil moisture depletion and ET varied considerably between sites and from year to year. Aspen (Populus tremuloides) sprouts utilized from 0.48 to 4.50 in. less water from 6 ft. of soil than mature aspen; Gambel oak (Quercus gambelii) sprouts utilized from 0.25 to 1.15 in. less water than mature oak. By converting aspen to grass, ET losses were reduced from 1.08 to 5.18 in. from the surface 6 ft. of soil and up to 7.59 in. from a 9-ft. soil depth. (Knapp-USGS)
W71-04242

2E. Streamflow and Runoff

THE INFLUENCE OF LANDFORM AND PRECIPITATION PARAMETERS ON FLOOD HYDROGRAPHS,
Indiana Univ., Bloomington. Dept. of Geography; and Oregon State Univ., Cornwallis. Dept. of Civil Engineering.
Michael C. Roberts, and Peter C. Klingeman.
Journal of Hydrology, Vol 11, No 4, p 393-411, November 1970. 19 p, 11 fig, 2 tab, 15 ref. OWRR Project A-001-ORE (7).

Descriptors: *Hydrograph analysis, *Hydraulic models, *Rainfall-runoff relationships, Antecedent precipitation, Depth-area-duration analysis, Duration curves, Permeability, Overland flow, Hydraulic similitude, Rainfall intensity, Hydrographs.
Identifiers: *Watershed models.

A laboratory model watershed was used to determine important factors that affect stream hydrographs. The factors selected for experimental variation are rainfall intensity, rainfall duration, storm movement, permeability, and antecedent moisture conditions. Systematic changes in the flood hydrographs, caused by controlled variation of these factors, are described. Given 100% basin cover and wet antecedent conditions, the intensity of rainfall causes a marked difference in the magnitude of the discharge hydrograph. The direction of storm travel over a drainage basin may aggravate or reduce flood peaks. In regions subject to recurrent directions of major storms, the predominant direction of storm movement can give definition to a 'characteristic' hydrograph shape. Variations in this shape may result from differences in the rate of storm movement. With increasing permeability, time to equilibrium also increases. Antecedent moisture conditions are very important in determining flood magnitude. The pre-storm moisture level is responsible for wide variations in peak discharge values resulting from similar storm events. (Knapp-USGS)
W71-03871

MEASURING STREAM DISCHARGE USING THE DYE-DILUTION METHOD (CHEMICAL GAUGING),
New Zealand Forest Service, Wellington. Protection Forestry Branch.
For primary bibliographic entry see Field 07B.
W71-03930

FLOOD PROFILE STUDY, HOOSIER CREEK, LINN COUNTY, IOWA,
Geological Survey, Iowa City, Iowa.
Harlan H. Schwob.
Geological Survey Open-file report, October 1970. 18 p, 8 plate, 2 ref.

Descriptors: *Floods, *Profiles, *Iowa, Urbanization, Water levels, Data collections, Mapping, Maps, Surveys, Flood damage, Flood plains, Planning, Water management (Applied).
Identifiers: *Hoosier Creek (Iowa), *Linn County (Iowa), *Cedar Rapids (Iowa).

A flood-profile study was made for Hoosier Creek and its tributary South Hoosier Creek, Linn County, Iowa. The reaches studied extend from near the south Linn County line upstream to U.S. Highway 218 on Hoosier Creek, and from the mouth to U.S. Highway 218 on South Hoosier Creek. A total of about 11 miles of stream is included in the two reaches. The profiles shown in the report are computed for a very large flood under existing valley conditions and for a smaller flood under two assumed conditions of encroachment. This information can be used to supplement the existing county zoning ordinances for flood plains and to aid in future flood-plain management when part or all of the area, adjacent to the south limit of the city of Cedar Rapids, is urbanized. (Knapp-USGS)
W71-03932

A PROPOSED STREAMFLOW DATA PROGRAM FOR NEW YORK,
Geological Survey, Albany, N.Y.
For primary bibliographic entry see Field 07A.
W71-03933

MAP OF TOTAL STREAMFLOW FROM THE TERRITORY OF THE SOVIET UNION,
Akademiya Nauk SSSR, Moscow. Institut Geografii.
I. N. Dreyer.
Translated from Izvestiya Akad nauk SSSR, ser geogr No 6, p 69-73, 1969. Soviet Hydrology: Selected Papers, No 5, p 519-524, 1969. 6 p, 1 map, 1 tab, 17 ref.

Descriptors: *Maps, *Runoff, *Streamflow, River flow, Mapping, Discharge (Water), River forecasting, Water management (Applied), Hydrologic data, Data collections.
Identifiers: *USSR, *Streamflow maps.

A map of the streamflow of the USSR is presented and former streamflow compilations are reviewed. The annual streamflow of the USSR is about 4350 cu km. The data were compiled on working maps scaled 1:10 million. (Knapp-USGS)
W71-03960

HYDRAULIC RESISTANCE AND FORMULA FOR COMPUTING THE AVERAGE FLOW VELOCITY OF MOUNTAIN RIVERS,
V. V. Golubtsov.
Translated from Trudy KazNIGMI, No 33, p 30-41, 1969. Soviet Hydrology: Selected Papers, No 5, p 500-511, 1969. 12 p, 3 fig, 1 tab, 26 ref, append.

Descriptors: *Open channel flow, *Hydraulics, *Stage-discharge relations, Chezy equation, Mannings equation, Roughness (Hydraulic), Depth, Slopes, Equations, Turbulent flow, Turbulence, Hydraulic gradient.
Identifiers: *USSR, *Mountain stream hydraulics.

The resistance to flow in mountain rivers generally increases as a result of the effect of hydrodynamic parameters (slope, in particular) on the conditions of flow, rather than as a result of increasing channel roughness. Only the physical conditions of flow in rivers with slopes less than 0.001 correspond to the square law of resistance. Pressure losses through resistance to flow in rivers with slopes less than 0.004 are proportional to average velocity in the sixth power. A gradual transition from the square law of resistance to resistances proportional to the average flow velocity in the sixth power is observed in the range of slopes 0.001 to 0.004. These results substantiate the conclusion derived from laboratory experiments that there is a resistance zone where velocity continues to affect resistance through the Froude number for increasing values of the Reynolds number. To compute the average velocity of mountain rivers of slope greater than 0.001 an empirically derived exponential equation relates velocity to slope, flow depth, and hydraulic roughness. (Knapp-USGS)
W71-03961

HYDRAULIC CRITERIA OF STREAMS WITH A MOBILE BOTTOM,
For primary bibliographic entry see Field 02J.
W71-03965

INFLUENCE OF THE BANKS AND FLOOD PLAIN ON CHANNEL CONVEYANCE,
I. F. Karasev.
Translated from Trudy Gos Gidrol Inst-ta, No 172, p 3-21, 1969. Soviet Hydrology: Selected Papers, No 5, p 429-442, 1969. 14 p, 6 fig, 2 tab, 15 ref.

Descriptors: *Floods, *Flood plains, *Channel morphology, *Chezy equation, *Open channel flow, Hydraulics, Discharge (Water), Mannings equation, Roughness (Hydraulic), Hydraulic radius.
Identifiers: *USSR.

The momentum equation, which allows for mass exchange at the lateral boundaries, permits an overall estimate of the influence of the banks and flood plain on flood conveyance. The working relationships include a limited number of empirical parameters: one for a channel without a flood plain and two for the flood-plain channel. The dynamic scheme, which allows for the mechanism of lateral mass exchange, has significant advantages over the correlative-statistical relationships, which give less accurate results. (Knapp-USGS)
W71-03968

PATTERN OF VARIATION OF THE LENGTH OF FREELY MEANDERING RIVERS,
For primary bibliographic entry see Field 02J.
W71-03969

MUD FLOWS AND FLOODS AND THEIR CONTROL,
For primary bibliographic entry see Field 02J.
W71-03970

WATER DISCHARGE TRAVEL TIME COEFFICIENTS,
V. I. Moklyak, and L. V. Shcherbak.
Translated from Trudy UkrNIGMI, No 85, 1969, p 11-15. Soviet Hydrology: Selected Papers, No 4, p 370-375, 1969. 6 p, 1 fig, 12 ref.

Descriptors: *Stage-discharge relations, *Flood forecasting, *Velocity, Discharge (Water), Discharge coefficients, River forecasting, Streamflow forecasting.
Identifiers: USSR, *Travel time (Streamflow).

Methods of computing unsteady flow of streams during floods are briefly reviewed. New methods proposed in the USSR use travel time as the main parameter, but in real streams with variable cross-sectional areas, this is too difficult to compute. Formulas are given for use in estimating travel time coefficients using discharge, stage, and the average dimensions of the stream channel in question. (Knapp-USGS)
W71-03973

COMPUTATION OF FLOW IN GLACIER-FED RIVERS,
B. A. Kamalov.
Translated from Trudy TSANIGMI, No 44 (59), 1969, p 66-80. Soviet Hydrology: Selected Papers, No 4, p 388-398, 1969. 11 p, 3 fig, 2 tab, 15 ref.

Descriptors: *Streamflow forecasting, *Glaciers, *Regimen, *Melt water, *Melting, Climates, Altitude, Heat budget, Rainfall-runoff relationships, Runoff, Snowmelt, Water sources.
Identifiers: *USSR, *Glacial runoff.

Methods of analysis of flow in the mountains involve difficulties because of the few meteorological stations, especially in the high mountains, and meteorological factors vary greatly over the territory. For this reason, a system of methods of hydrologic computations for mountain areas was developed in the USSR from long-period investigations. These methods are based on the vertical zonality of natural processes in general and hydrometeorological processes in particular. In some rivers glaciers contribute a large portion of the annual flow. For example, the melting of glaciers accounts for 32% of the annual flow of the Sokh River, 35% of the Zarafshan River, 25% of the Aksu River, and 20% of the Isfayram River. There is a close local ralationship between the runoff rate of glacier-fed rivers and the ratio of average catchment elevation to the average height of the firn line. This relationship is described statistically. There is no common relationship between the runoff rate and the ratio of catchment elevation to the average height of the firn line for large regions. The reason for this is that glaciers of widely separate regions have different thermal and mass balances. (Knapp-USGS)
W71-03975

CHARACTERISTICS OF THE CONSTRUCTION OF EQUALLY PROBABLE FLASH FLOOD HYDROGRAPHS,
P. F. Vishnevskiy, and G. M. Shcherbak.
Translated from Trudy UkrNIGMI, No 85, 1969, p 85-91. Soviet Hydrology: Selected Papers, No 4, p 375-381, 1969. 7 p, 3 fig, 3 tab, 5 ref.

Descriptors: *Flash floods, *Hydrographs, *Flood forecasting, *Probability, Hydrograph analysis, Time series analysis, Statistical methods, River forecasting, Runoff forecasting, Rainfall-runoff relationships.
Identifiers: *Probability hydrographs.

Proper and economical planning of spillway installations and bridges requires hydrographs of flows of varying probability. These hydrographs also serve as the basis of water management computations for high-water and flood flow regulation. To construct the equally probable rain flood hydrograph, the daily rain water inflow depths of different probability of excess are obtained after statistical analysis of the series of computed inflow depths. The difference between the maximum discharges of the design hydrographs for the given probability of excess is about 24%, which is substantial. To estimate the reliability of the computed equally probable flash flood hydrographs, these hydrographs were compared with observed hydrographs. The comparison was made between the computed equally probable hydrographs of a probability of excess p — 2.0% and p — 3.0% and observed maximum flash flood hydrographs in 1897 and 1933, whose empirical probability approximately corresponds to the computed probability. This comparison showed good agreement. (Knapp-USGS)
W71-03976

DETERMINATION OF THE DISTRIBUTION OF RAINFALL FLOODS IN LARGE CATCHMENTS USING HYDROMETEOROLOGICAL DATA,
Meteorological Office, New Delhi (India).
S. Banerji, and D. C. Mantan.
In: Floods and Their Computation, Vol 1, International Association of Scientific Hydrology Publication No 84 (Unesco-WMO), p 442-450, 1969. 9 p, 6 fig, 5 tab, 5 ref.

Descriptors: *Rainfall-runoff relationships, *Flood forecasting, *Peak discharge, *Low flow, Infiltration, Water storage, Hydrologic data, Routing, Water yield, Streamflow forecasting, Antecedent precipitation, Depth-area-duration analysis, Hydrograph analysis, Base flow.
Identifiers: India, Streamflow estimating.

Lack of hydrological data is an impediment for design purposes of dams and reservoirs in most of the catchments in the developing countries. Some have fortunately a long period of hydrometeorological data for these catchments. A method has been evolved by which the daily flood formation at the point of discharge due to rain storms affecting different zones of the catchment is determined. An equation, in which the storage factor is directly related to the antecedent precipitation and as such takes account of infiltration and retention capacity of the basin, is used for the determination of the flood crest. Since the contribution from different zones of the larger catchment to the flood at the point of outflow is estimated on its antecedent and concurrent rainfall reduced by the storage factor appropriate to the wetness of the catchment, this method does away with the laborious process of flood estimation by stream routing methods. The method is not only useful in the evaluation of day to day crest forecast for a large basin influenced by uneven rainfall distribution, but it may also be used for estimation of low flow for countries subject to droughts.-(Knapp-USGS)
W71-03977

EVALUATION OF MAXIMUM RAINFALL DISCHARGE FROM A REGION OF DEFICIENT RAINFALL DATA,
Dum Dum Airport, Calcutta (India); and Meteorological Office, New Delhi (India).
R. K. Datta, and D. K. Gupta.
In: Floods and Their Computation, Vol 1, International Association of Scientific Hydrology Publication No 84 (Unesco-WMO), p 432-442, 1969. 11 p, 3 fig, 4 tab, 6 ref.

Descriptors: *Rainfall-runoff relationships, *Estimating, *Flood forecasting, *Streamflow forecasting, *Statistical methods, Hydrograph analysis, Storm runoff, Duration curves, Depth-area-duration analysis.
Identifiers: India.

It is advantageous to use a river catchment or a part of one as a unit for quick evaluation of average basin rainfall and thus base the possible discharge on the highest rainfall recorded in the area. The Gompertz equation, which is flexible to represent various types of depth area relation, may be utilized to compute average rainfall in a river catchment based on a central value. The physical method of picking up central rainfall values in case of meager rainfall reports is suggested. (Knapp-USGS)
W71-03978

DETERMINATION OF MAXIMUM FLOOD FLOW AND THE PROBABILITY OF ITS BEING EXCEEDED, USING INCOMPLETE INFORMATION (FRENCH),
Electricite de France, Chatou. Centre de Recherches et d'Essais.
J. Jacquet, and J. Bernier.
In: Floods and Their Computation, Vol 1, International Association of Scientific Hydrology Publication No 84 (Unesco-WMO), p 419-431, 1969. 13 p, 6 fig, 2 ref.

Descriptors: *Rainfall-runoff relationships, *Flood forecasting, *Frequency analysis, *Peak discharge, *Probability, Statistical methods, Data collections, Unit hydrographs, Hydrograph analysis, Streamflow forecasting.
Identifiers: France.

The classifical methods of frequency analysis of floods cannot be used in the case of incomplete information (small sample of flood data, large sample of rainfall data). If the rainfall and discharge data permit the definition of a function, such as the unit hydrograph, it is possible to calculate the probabilities of a flood based upon the stochastic process of rainfall and runoff coefficients. This method is explained and its application and comparisons with classical methods are given. (Knapp-USGS)
W71-03979

ANALYSIS OF THE RELATION BETWEEN PRECIPITATION AND FLOOD FLOW WITH THE AID OF A TRIPLE TRANSFORMATION BASED ON THE UNIT HYDROGRAPH METHOD (FRENCH),
Transdanubian Water Authority, Szekesehervar (Hungary). Water Management.
For primary bibliographic entry see Field 02A.
W71-03980

CONSTRUCTION OF THE UNIT HYDROGRAPH BY THE METHOD OF HYDROLOGIC ANALOGY (FRENCH),
Research Inst. for Water Resources Development, Budapest (Hungary); and Transdanubian Water Authority, Szekesfehervar (Hungary). Water Management.
P. Wirth, and I. Zsuffa.
In: Floods and Their Computation, Vol 1, International Association of Scientific Hydrology Publication No 84 (Unesco-WMO), p 404-408, 1969. 5 p, 3 fig, 8 ref.

Descriptors: *Rainfall-runoff relationships, *Unit hydrographs, *Hydrograph analysis, *Synthetic hydrology, Statistical methods, Flood forecasting, Estimating, Discharge (Water), Peak discharge.
Identifiers: Synthetic hydrographs, Hungary.

The analysis of hydrographs observed on experimental basins in Hungary is outlined. The relations between the parameters of the unit hydrographs and the physical and geographical characteristics of the basin are analyzed. The methods of estimation of the principal elements of the unit hydrograph, when there are no discharge records, are given. (Knapp-USGS)
W71-03981

COMPUTATION OF MAXIMUM STORM DISCHARGE OF MOUNTAIN RIVERS,
Akademiya Nauk Armyanskoi SSR, Erevan; and Ministry of Reclamation and Water Economy, Erevan (USSR). Water Problems and Hydrotechnics Research Inst.
For primary bibliographic entry see Field 02A.
W71-03982

EVALUATION OF MAXIMUM FLOW OF FLOODS USING PRECIPITATION DATA (FRENCH),
Grenoble Univ. (France).
For primary bibliographic entry see Field 02A.
W71-03983

ANALYSIS OF FLOOD DURATION (FRENCH),
Transdanubian Water Authority, Szekesfehervar (Hungary). Water Management.
I. Zsuffa.
In: Floods and Their Computation, Vol 1, International Association of Scientific Hydrology Publication No 84 (Unesco-WMO), p 362-368, 1969. 7 p, 5 fig, 2 ref.

Descriptors: *Flood forecasting, *Frequency analysis, *Duration curves, Depth-area-duration analysis, Probability, Statistical methods, Flood protection.
Identifiers: Hungary, Danube River.

Knowledge of the height of a floodwave is essential from the point of view of the size of the protection dikes. The duration of the flood must be taken into consideration when considering the resistance of dikes to absorption, erosion and breaking. Each of these factors can be considered as a random variable. The methods used for estimating the probability of different heights of flood are well known. Methods are described for the determination of the function of floodwave duration distribution. (Knapp-USGS)
W71-03984

DETERMINATION OF MAXIMUM FLOW AND FLOOD HYDROGRAPHS (FRENCH),
National Office of Irrigation, Rabat (Morocco).
R. Hazan, and D. Lazarevic.
In: Floods and Their Computation, Vol 1, International Association of Scientific Hydrology Publication No 84 (Unesco-WMO), p 354-361, 1969. 8 p, 5 fig.

Descriptors: *Flood forecasting, *Peak discharge, Frequency analysis, Hydrograph analysis, Gaging stations, Networks, Statistical methods, Hydrology.
Identifiers: Morocco.

A synthetic study of the hydrology of Morocco has permitted the deduction of the laws of evolution in hydrology thus making possible the computation of peak discharges for different frequencies, the evaluation of the volume of flood flows and the determination of flood hydrographs in a characteristic zone. The method reported enables the rapid computation of these data for zones without a gaging network and it can be widely employed. (Knapp-USGS)
W71-03985

MAXIMUM DISCHARGE OF MAJOR RIVERS IN LARGE FLOOD PLAINS IN EAST PAKISTAN,
East Pakistan Water and Power Development Authority, Dacca.
Faiz Ahmed.

In: Floods and Their Computation, Vol 1, International Association of Scientific Hydrology Publication No 84 (Unesco-WMO), p 336-349, 1969. 14 p, 7 fig, 3 tab, 5 ref.

Descriptors: *Floods, *Peak discharge, Data collections, Hydrologic data, Water supply, Sediment load, Hydrology, Streamflow, Discharge (Water), Hydrographs, Frequency analysis.
Identifiers: East Pakistan, Brahmaputra River.

Measurement of maximum discharges of the major rivers in East Pakistan is a complex problem. Results of a study carried out in 1965 are outlined. About 70% of total flow entering East Pakistan was contributed by the Brahmaputra which has a maximum weekly discharge of 29.8 million acre feet; the Ganges contributed about 28% and the remaining 2% was contributed by small streams. The maximum storage was small at the peak flood in relation to the water passing through the system. The outflow lagged (on account of storage) only slightly behind the inflow. Rainfall was an important factor and kept pace with the increase in storage up to peak value. The maximum flood of 4.5 million cfs given by Mayer's rating or 4.0 million cfs subtracting 10% as escape flow, has a mean return period of 1500 years. (Knapp-USGS)
W71-03986

PROBABLE FLOOD DISCHARGES OF THE PO RIVER TRIBUTARIES,
Hydrographic Office of the Po River, Parma (Italy).
U. Raffa.
In: Floods and Their Computation, Vol 1, International Association of Scientific Hydrology Publication No 84 (Unesco-WMO), p 330-336, 1969. 7 p, 3 fig, 2 tab.

Descriptors: *Flood forecasting, *Statistical methods, *Rainfall-runoff relationships, Discharge (Water), Stage-discharge relations, Frequency analysis.
Identifiers: Po River (Italy).

The procedure adopted for the elaboration of the probable statistical characteristics of the flooding of the Po River of Italy is described and the application of the Gherardelli-Marchetti formula is illustrated. The procedure yields unit flood discharge for a given probability. Tables and the graphs are designed for the rapid evaluation of the first approximation of flood discharges in a river cross-section, knowing the morphological characteristics of the drainage basin and its area. (Knapp-USGS)
W71-03987

FORMATION OF RAINFALL FLOODS ON SMALL WATERSHEDS. PRINCIPLES OF MAXIMUM STORM RUNOFF COMPUTATION,
Vsesoyuznyi Nauchno—Issledovatelskii Institut Vodosnabzheniya, Kanalizatsii, Gidrotekhnicheskikh Sooruzhenii i Inzhenernoi Gidrogeologii, Moscow (USSR); and Khabarovsk Inst. of Railway Engineers (USSR).
For primary bibliographic entry see Field 02A.
W71-03988

DERIVATION OF A GENERAL FLOOD WAVE HYDROGRAPH FROM A CONTINUOUS WATERSHED WATER BALANCE,
Guelph Univ. (Ontario). School of Agricultural Engineering; and Ceskoslovenska Akademie Ved, Prague. Inst. of Hydrodynamics.
H. D. Ayers, and J. Balek.
In: Floods and Their Computation, Vol 1, International Association of Scientific Hydrology Publication No 84 (Unesco-WMO), p 505-510, 1969. 6 p, 6 fig, 5 ref.

Descriptors: *Water balance, *Runoff forecasting, *Mathematical models, Routing, Hydrograph analysis, Rainfall-runoff relationships, Discharge (Water), Water storage, Flood forecasting, Synthetic hydrology.
Identifiers: Flood hydrographs.

A mathematical model providing hourly water balance information for summer, winter and combined regimes was developed. The model yields hourly volumes of surface runoff in addition to much other supplementary output information. The routing section of the model produces the three components of the hydrograph. Constant and variable parameters characterizing a general watershed are discussed from the viewpoint of surface runoff development and time distribution. (Knapp-USGS)
W71-03989

PRACTICAL METHODS OF ESTIMATING MAXIMUM FLOODS (FRENCH),
Consejo Superior di Investigaciones Cientificas, Madrid (Spain). Instituto de Hidrologia.
R. Heras.
In: Floods and Their Computation, Vol 1, International Association of Scientific Hydrology Publication No 84 (Unesco-WMO), p 492-504, 1969. 13 p, 10 fig, 7 tab, 5 ref.

Descriptors: *Flood forecasting, *Rainfall-runoff relationships, Statistical methods, Depth-area-duration analysis, Routing, Data collections, Streamflow forecasting, Estimating, Hydrograph analysis.
Identifiers: Spain.

Because of the great irregularity of river regimes in Spain and to the total or partial absence of hydrological data, the problem of maximum river flood computation is a very complex one. From the point of view of the economy, it is important to forecast flood levels and maximum discharges. This report contains a summary of different methods (direct, empirical, statistical and hydrometric), which in general are used simultaneously to compare different results and to try to estimate the highest flood values with the maximum possible accuracy. (Knapp-USGS)
W71-03990

CALCULATION OF THE MAXIMUM RUNOFF IN FLOODS FROM RAINFALL OVER THE TERRITORIES OF THE UKRAINE AND MOLDAVIA (WITH NO OR INSUFFICIENT HYDROMETRICAL DATA),
Ukrainskii Nauchno-Issledovatelskii Gidrometeorologicheskii Institut, Kiev (USSR).
For primary bibliographic entry see Field 02A.
W71-03991

METHOD OF ESTIMATING STORM RUNOFF FROM SMALL DRAINAGE BASINS,
Zakavkazskii Nauchno-Issledovatelskii Gidrometeorologicheskii Institut, Tiflis (USSR).
C. D. Rostomov.
In: Floods and Their Computation, Vol 1, International Association of Scientific Hydrology Publication No 84 (Unesco-WMO), p 462-472, 1969. 11 p, 3 fig, 3 tab.

Descriptors: *Storm runoff, *Maximum probable flood, *Rainfall-runoff relationships, *Depth-area-duration analysis, Routing, Time of concentration, Duration curves, Mass curves, Hydrographs, Analytical Techniques.
Identifiers: USSR.

Maximum regional discharge is examined as a function of morphometric data, vegetal cover and climatic (storm) conditions. The solution is based on the principle of equality of the time of concentration and of the storm duration, which is composed of the time of travel along the slopes and along the river channel. The flow of water along the slopes is considered as steady flow; its analysis is based on the water balance equation of an elementary plot. For generalization and averaging of phenomena during runoff formation the concept of 'adjusted' length of the watercourse is used. This facilitates solution of the design storm duration, which is the principal element of storm runoff computation. For a more accurate account of runoff factors, some features of irregularity of storm intensity, storm areal distribution, and of the shape of the catchment area have been introduced in design formulas. (Knapp-USGS)
W71-03992

BEDLOAD FORMULAS. PART A. A SELECTION OF BEDLOAD FORMULAS. PART B. PROGRAM LISTINGS FOR BEDLOAD FORMULAS,
Pennsylvania State Univ., University Park. Dept. of Civil Engineering.
Sam Shulits, and Ralph D. Hill, Jr.
Available from NTIS as PB-194 950, $3.00 in paper copy, $0.95 in microfiche. Hydraulics Laboratory Bulletin, ARS-SWC-1, Dec 1968. 218 p, 89 ref. Dept of Agriculture Contract 12-14-1000-8872 (41).
Identifiers: *Bed load, Mathematical models, *Channels, Waterways, Sediment transport, Channel flow, Erosion, FORTRAN, Computer programs.

Formulas for computing bedload are reviewed, and FORTRAN program listings are given for digital computer solution of 14 of them. The programs are for the formulas of Schoklitsch, Meyer-Peter, Casey, Haywood, Straub, Waterways Experiment Station, Shields, Kalinske, Meyer-Peter and Muller, Eizerman and Frijlink, Laursen, Rottner, and Einstein. Results of the formulas are compared by calculating and plotting sediment discharge against water discharge for all of them. Each formula is presented in its original form and units, and its use is explained as the originator intended. It is concluded that 3 of the formulas give the best results, with adequate agreement with data. The Schoklitsch (1934) formula is selected as the best relation of bedload to discharge. The Straub and they Meyer-Peter and Muller formulas are selected as the best relations of bedload to tractive force. The 3 formulas are valid for effective particle diameters from 0.3 to 7 mm. The Schoklitsch (1934) formula is proposed as the best of the 3 because of its simple form and because it produces directly a bedload-discharge rating curve.
W71-03999

INVESTIGATION OF AIRFIELD DRAINAGE ARCTIC AND SUBARCTIC REGIONS, SUPPLEMENT TO PART I, FIELD RECONNAISSANCE AND ANALYSIS,
Minnesota Univ., Minneapolis. St. Anthony Falls Hydraulic Lab.
For primary bibliographic entry see Field 04A.
W71-04002

SUPERPOSITION OF SUBMONTHLY FLOWS IN STOCHASTIC HYDROLOGY,
North Carolina Univ., Chapel Hill.
David H. Moreau.
Presented at 17th ASCE Hydraulics Division Conference, Logan, Utah, Aug 20-22, 1969. 14 p, 2 fig, 2 tab, 7 ref, append. OWRR Project A-043-NC (1).

Descriptors: *Stochastic processes, *Hydrology, *Streamflow, *Monthly, Time, Monte Carlo method, North Carolina.
Identifiers: Maxima, Minima, Haw River.

The object of this paper was to report on progress of current research to divise a technique for superimposing variability of stream flows having a duration of less than a month onto monthly flow sequences, whenever the probability of an extreme event occurring within the month was sufficiently large. There were two analyses of interest; first, an examination of relationships between maxima and minima of stream flows averaged over some submonthly time period to flows averaged over a month; and second, a technique for superimposing sub-monthly flows on monthly flows. Reported were results of: (a) a Monte Carlo technique for finding distributions of peak-to-mean and minima-to-mean ratios of weekly flows on monthly values, and (b) a technique for generating sub-monthly flows such that the first three moments and correlations among deviations of sub-monthly flows from

monthly flows were preserved. Analyses were based on 34 years of recorded observations on the Haw River at Pittsboro, North Carolina near the construction site for New Hope Dam. (Kriss-Cornell)
W71-04040

CHAIN MODEL OF RIVER MEANDERS,
Illinois Univ., Urbana. Dept. of Metallurgy and Mining Engineering.
T. R. Thakur, and A. E. Scheidegger.
Journal of Hydrology, Vol 12, No 1, p 25-47, December 1970. 23 p, 14 fig, 13 ref.

Descriptors: *Meanders, *Geomorphology, *Channel morphology, *Simulation analysis, Statistical methods, Stochastic processes, Monte Carlo method, Correlation analysis, Profiles, Model studies, Probability.
Identifiers: Meander models.

For an explanation of river meanders, a statistical approach is promising. In order to put such an approach upon a sound theoretical basis it is necessary to calculate expectation values of certain observables (such as the meander spectrum) over a well-defined ensemble. Because of the difficulty of random-generating meander patterns for given boundary conditions, an empirical approach was used. A chain was used to generate simulated meanders. Keeping both ends of the chain fixed, an ensemble of random curves of a given sinuosity can be generated. Different ensembles can be generated by varying the end separation, keeping the length of the chain constant. Values of statistical relationships were found from the ensembles and compared with data obtained from actual rivers. (Knapp-USGS)
W71-04124

THE UNIVERSALISATION OF THE CO-ORDINATES OF LOGARITHMIC WEIR PROFILES,
Indian Inst. of Science, Bangalore. Dept. of Civil and Hydraulic Engineering.
For primary bibliographic entry see Field 07B.
W71-04127

THE TRAPEZOIDAL FREE OVERFALL,
Alberta Univ., Edmonton. Dept. of Civil Engineering.
For primary bibliographic entry see Field 08B.
W71-04128

EXPERIMENTAL STUDIES ON LINEAR PROPORTIONAL WEIRS WITH TRIANGULAR BOTTOMS,
Indian Inst. of Science, Bangalore. Dept. of Civil and Hydraulic Engineering.
For primary bibliographic entry see Field 08B.
W71-04129

CATALOG OF INFORMATION ON WATER DATA, EDITION 1970-INDEX TO SURFACE WATER SECTION.
Geological Survey, Washington, D.C. Office of Water Data Coordination.
For primary bibliographic entry see Field 07C.
W71-04151

PREDICTION OF FLOODS FROM HEAVY RAINFALL,
Japan Meteorological Agency, Tokyo. Forecast Section.
Kenji Ishihara.
In: Forecasting of Heavy Rains and Floods, Proc Joint Seminar of Regional Associations 2 and 5 of World Meteorological Organization, Nov 11-23, 1968, Kuala Lumpur, Malaysia, published by World Meteorological Organization, Geneva, p 113-172, 1970. 60 p, 28 fig, 7 tab, 10 ref.

Descriptors: *Flood forecasting, *Flood routing, *Rainfall-runoff relationships, Hydrograph analysis, Warning systems, Rational formula, Precipitation intensity, Antecedent precipitation.
Identifiers: *ECAFE, *Asia.

Methods of flood forecasting are reviewed and illustrated by worked examples. The methods discussed are the Thiessen polygon method, the isohyetal method, hydrograph analysis, antecedent moisture calculations, unit hydrographs, rational formula, the Muskingum method, and the Puls method. Proper organization and operation of flood forecasting services involves personnel selection, data collections, data collection network, and information distribution facilities. (Knapp-USGS)
W71-04159

SEVERE CYCLONIC STORM RESPONSIBLE FOR FLASH FLOOD IN PAKOKKU AND MONYWA DISTRICTS DURING THE MONTH OF OCTOBER 1967,
Burma Meteorological Dept., Rangoon.
For primary bibliographic entry see Field 02B.
W71-04164

LOWER AND MIDDLE IRRAWADDY FLOODS IN RELATION TO HEAVY RAINFALL IN THE HEAD WATER REGIONS OF CHINDWIN AND IRRAWADDY RIVERS,
Burma Meteorological Dept., Rangoon.
Ba Kyi.
In: Forecasting of Heavy Rains and Floods, Proc Joint Seminar of Regional Associations 2 and 5 of World Meteorological Organization, Nov 11-23, 1968, Kuala Lumpur, Malaysia, published by World Meteorological Organization, Geneva, p 221-242, 1970. 22 p, 16 fig, 1 tab, 4 ref.

Descriptors: *Floods, *Rainfall-runoff relationships, *Flood forecasting, *Monsoons, *Tropical cyclones, Synoptic analysis, Rainfall intensity, Storms, Weather forecasting, Climatology, Meteorology.
Identifiers: *ECAFE, *Burma.

Studies of 15 floods in the middle and lower Irrawaddy River, Burma indicated that all widespread floods were associated with rainstorms in the monsoon trough of at least 3 days duration. Because the northern part of the country is a mountainous region it appears that the active monsoon trough effect was added by the orographic effect, thereby producing intense rainstorms favoring formation of floods in the middle and lower Irrawaddy catchments. For major floods the lag time between the end of significant rain in the head-water regions and the time of occurrence of peak at Henzada was about 15 days. Forecasting of floods along middle and lower Irrawaddy by using known meteorological conditions in the head-water regions of Chindwin and Upper Irrawaddy appears to have advantages over any of the existing methods because preliminary warning can be issued well in advance. (Knapp-USGS)
W71-04165

THE PROBLEM OF FLOOD PREDICTION ON THE EAST COAST OF WEST MALAYSIA,
Drainage and Irrigation Dept., Kuala Lumpur (Malaysia). Research Station.
For primary bibliographic entry see Field 02B.
W71-04167

HEAVY RAINFALL IN PAKISTAN AND ITS ASSOCIATED FLOOD,
Pakistan Meteorological Dept., Karachi. Central Secretariat.
For primary bibliographic entry see Field 02B.
W71-04168

HEAVY RAINFALL AND ASSOCIATED FLOODS IN WEST PAKISTAN,
Regional Meteorological Center, Lahore (Pakistan).
For primary bibliographic entry see Field 02B.
W71-04169

SNOWMELT AND WATER YIELD FROM SNOW COVER,
State Hydrological Inst., Leningrad (USSR).
For primary bibliographic entry see Field 02C.
W71-04171

A METHOD FOR THE COMPUTATION OF WATER YIELD FROM SNOW DURING SNOWMELT PERIOD,
State Hydrological Inst., Leningrad (USSR).
For primary bibliographic entry see Field 02C.
W71-04172

SOME PROBLEMS OF DETERMINING THE WATER EQUIVALENT OF THE SNOW COVER,
Research Inst. for Water Resources Development, Budapest (Hungary).
For primary bibliographic entry see Field 02C.
W71-04173

SOME RESULTS OF INVESTIGATION AND REPRESENTATION OF SNOW SUPPLY AND THE MELTING OF SNOW,
Meteorologischer Dienst der Deutschen Demokratisches Republik, Halle. Amt fuer Meteorologie.
For primary bibliographic entry see Field 02C.
W71-04174

RUNOFF CONDITIONS DURING SNOW THAWING IN THE MORAVIAN-SILESIAN BESKIDS,
Research Inst. of Amelioration, Prague (Czechoslovakia).
For primary bibliographic entry see Field 02C.
W71-04175

CALCULATION OF FLOOD WAVES FOR A LARGE RIVER SYSTEM,
Gidrometeorologicheskii Nauchno-Issledovatelskii Tsentr, Moscow (USSR).
N. S. Nechaeva, and L. S. Kuchment.
In: Floods and Their Computation, Vol 2, International Association of Scientific Hydrology Publication No 85 (Unesco-WMO), p 663-671, 1969. 9 p, 2 fig, 14 ref.

Descriptors: *Flood forecasting, *Computer programs, *Routing, *Unsteady flow, Streamflow forecasting, Hydrograph analysis, Water storage, Reservoirs, Discharge (Water), Peak discharge, Gaging stations, Stream gages, Analog computers, Digital computers.
Identifiers: Volga River System (USSR).

For lack of hydrological and morphometric information it is difficult to use hydrodynamical methods of unsteady flow calculation in developing practical methods of routing flood waves on large river systems. At the same time this information is sufficient for the application of engineering methods making it possible to demonstrate the general scheme of flood wave movement along the river system without detailing complicated processes occurring on some river stretches. Such methods include those which are based on the use of Duhamel's integral and on the relation of discharges and volumes. Parameters needed for the use of these methods can be determined by means of observations of the hydrological regime. When using engineering methods of routing of unsteady flow it is convenient to select empirical parameters with the help of electronic analog computers. These methods were used in developing the scheme of flood wave computation and forecast for the complex river system of Volga--Kama--Vyatka which has more than twenty inlet gaging sections. This system has been programmed for electronic computer and is used for daily issues of short-term forecasts during the period of floods. A timely

forecast is ensured by the natural time of travel from the inlet gaging sections of the system to the outlet. (Knapp-USGS)
W71-04176

A METHOD FOR THE CALCULATION OF SPRING FLOODS,
Ukrainskii Nauchno-Issledovatelskii Gidrometeorologicheskii Institut, Kiev (USSR).
J. A. Zhelesniak, and L. B. Byshovets.
In: Floods and Their Computation, Vol 2, International Association of Scientific Hydrology Publication No 85 (Unesco-WMO), p 681-688, 1969. 8 p, 3 fig, 1 tab, 2 ref.

Descriptors: *Flood forecasting, *Snowmelt, *Routing, Runoff forecasting, Streamflow forecasting, Frequency analysis, Hydrographs, Hydrograph analysis, Water yield, Peak discharge.
Identifiers: Isochrone method, USSR, Ukraine.

Flood forecasting by the genetic formula of runoff used in the USSR is preceded by the determination of water yield variation, distribution of areas between isochrones, and channel capacity. Water yield variation is determined by the runoff hydrograph of a small river by means of runoff retransformation within interisochrone areas. The distribution of areas between isochrones is found by using data on the length and area of catchments for the first order tributaries upstream of the given outlet, and lag time from the head to this outlet. The lag time is estimated by channel capacity, which can be determined by topographic measurements or by standard graphs depending on river length and discharge in the design outlet. Such graphs were constructed for different types of small rivers of the Ukraine. The suggested calculation method allows determination of the ordinates of a hydrograph of very rare frequency. (Knapp-USGS)
W71-04178

ANALYSIS OF SNOW MELT FLOODS,
Public Works Research Inst., Tokyo (Japan).
T. Kinosita, S. Aoki, and K. Ishizuka.
In: Floods and Their Computation, Vol 2, International Association of Scientific Hydrology Publication No 85 (Unesco-WMO), p 645-655, 1969. 11 p, 9 fig.

Descriptors: *Snowmelt, *Water yield, *Floods, *Small watersheds, *Investigations, Snow surveys, Moisture meters, Instrumentation, Runoff, Overland flow, Streamflow, Meteorology, Infiltration, Mapping, Energy budget.
Identifiers: Japan.

The Public Works Research Institute of Japan carried out research on forecasting of snowmelt floods from 1956 to 1965 at Yuzawa, Niigata Prefecture, in the temperate zone. The study watershed's catchment area is 147 sq km. The water equivalent, depth of snow, and the amount of snowmelt were measured by means of gamma-ray moisture meters. Estimating the total amount of snow on the basin at the end of winter, the mechanism of latent heat transferred into the snow layer, and the path of snowmelt water into small brooks are studied in detail in a smaller research watershed of 8.35 sq km. (Knapp-USGS)
W71-04179

ESTIMATION OF THE WATER SUPPLY FROM SNOW COVER IN THE SOUTHERN PART OF THE GERMAN D. R. IN SPRING 1965,
Meteorologischer Dienst der Deutschen Demokratischen Republik, Berlin. Forschungsinstitut fuer Hydrometeorologie.
For primary bibliographic entry see Field 02C.
W71-04180

A SIMPLE CASCADE WATERSHED MODEL,
California Univ., Davis. Dept. of Water Science and Engineering.
For primary bibliographic entry see Field 02A.
W71-04181

2F. Groundwater

EFFECT OF DISPERSION, GRAVITATIONAL SEGREGATION, AND FORMATION STRATIFICATION ON THE RECOVERY OF FRESHWATER STORED IN SALINE AQUIFERS,
Louisiana State Univ., Baton Rouge.
Anil Kumar, and Oscar K. Kimbler.
Water Resources Research, Vol 6, No 6, p 1689-1700, December 1970. 12 p, 9 fig, 3 tab, 11 ref. OWRR Project A-002-LA (6).

Descriptors: Water storage, *Underground storage, *Saline water systems, *Mixing, *Density stratification, Injection, Injection wells, Withdrawal, Groundwater movement, Diffusion, Dispersion, Flow, Stratified flow, Model studies, Hydraulic models, Aquifers, Artificial recharge.
Identifiers: *Underground water storage.

A CALCULATION PROCEDURE HAS BEEN DEVISED, USING EXISTING ANALYTICAL AND EMPIRICAL RELATIONSHIPS, TO PREDICT MIXING AND GRAVITATIONAL SEGREGATION IN A HORIZONTAL RADIAL FLOW SYSTEM. The procedure yields results that show excellent agreement with experimental results obtained with a three-dimensional laboratory flow model in which both mixing and gravitational segregation occur simultaneously. Thus validated, the calcuation procedure was applied to the prediction of the efficiency with which freshwater stored in saline aquifers might be recovered for later use. Low aquifer water salinity, low formation permeability, and low formation thickness lead to the most favorable recoveries. The calculation procedure indicates that recovery efficiency improves with the number of injection-production cycles, thus suggesting that even for unfavorable conditions the process might become feasible on a long-term basis. Graphical presentations show the relative importance of several pertinent variables including formation stratification. (Knapp-USGS)
W71-03870

OPTIMUM UTILIZATION AND MANAGEMENT OF WATER BEARING FORMATIONS HYDRAULICALLY CONNECTED TO A STRETCH OF THE CONNECTICUT RIVER,
Mass Univ., Amherst. Water Resources Research Center.
For primary bibliographic entry see Field 04B.
W71-03919

UTILIZATION OF THE STORAGE POTENTIAL OF RIVER VALLEY AQUIFERS,
Nebraska Univ., Lincoln. Water Resources Research Inst.
Ralph R. Marlette, and Leon S. Directo.
Available from NTIS as PB-197 117, $3.00 in paper copy, $0.95 in microfiche. Project Completion Report (1970). 15 p, 2 tab, 4 fig, 3 ref. OWRR Project A-011-NEB (1).

Descriptors: *Aquifer, *Groundwater, *Infiltration, Recharge, River quality, Water supply, Nebraska, *Artificial recharge.
Identifiers: Platte River.

The project objective was to determine the feasibility of recharging the Platte Valley Aquifer using river water infiltrated through basins. The operating problems were found to be formidable. Phase I of the study was a water quality survey of the Platte and Elkhorn Rivers. The river discharges were lower than normal and no floods occurred during the periods of sampling. Phase II consisted of an evaluation of the aquifer and preliminary recharge tests. The average transmissibility of the aquifer was 190,000 gpd/ft and the storage coefficient was 0.17. Since the water table was only 10 to 12 feet below the surface, pumping was required to lower the water level to provide storage for the recharge water. Phase III was the operation of the recharge facilities. After completion of the system in August, 1968, there was no water at the intake because of the low river stage.
W71-03924

AVAILABILITY OF GROUNDWATER IN WESTERN COWLITZ COUNTY, WASHINGTON,
Geological Survey, Tacoma, Wash.
D. A. Myers.
Report available from Wash State Dept of Ecology, Airdustrial Park, Olympia, Wash - Price $2.00. Washington Department of Ecology Water-Supply Bulletin No 35, 1970. 63 p, 7 fig, 2 plate, 7 tab, 13 ref.

Descriptors: *Water resources, *Groundwater, *Washington, *Water wells, *Hydrologic data, Data collections, Aquifers, Water quality, Chemical analysis, Water levels, Water table, Water level fluctuations, Water yield, Drawdown, Pumping, Withdrawal, Streamflow, Discharge measurement, Flow rates, Hydrographs, Specific capacity, Logging (Recording), Surface-groundwater relationships.
Identifiers: *Groundwater resources, *Cowlitz County (Washington).

Wells in Cowlitz County, Washington, produce water from Tertiary sedimentary and igneous rocks and Holocene alluvial materials. The wells range in depth from less than 6 to more than 600 feet, and yields from these wells range from less than 1 to more than 3,000 gpm. A wide variation in yields from alluvial aquifers is due primarily to the percentage of clay and silt they contain. Wells near the Columbia River tap the most productive of alluvial aquifers. Water levels in these wells show a response to river stage that is almost immediate and of the same general magnitude as the range in tidal stage of the river. Groundwater use in some parts of Cowlitz County is limited by the quality of the water. Observed dissolved-iron concentrations range from zero to 36.0 mg/l, and undesirable concentrations are common in the densely populated areas. In most other respects, the chemical quality of the groundwater is generally good. (Woodard-USGS)
W71-03934

GROUNDWATER RESOURCES OF COLLINGSWORTH COUNTY, TEXAS,
Geological Survey, Austin, Tex.
James T. Smith.
Texas Water Development Board Report 119, July 1970. 115 p, 10 fig, 8 tab, 22 ref.

Descriptors: *Groundwater, *Water wells, *Hydrologic data, *Data collections, *Texas, Water levels, Water quality, Water yield, Aquifer characteristics, Springs, Water utilization, Water consumption (Excludes consumptive use), Municipal water, Irrigation water, Industrial water, Stock water, Domestic water, Water sources, Chemical analysis, Pumping, Drawdown, Logging (Recording).
Identifiers: Collingsworth County, Tex.

An inventory of approximately 1,100 water wells and springs in Collingsworth County, Texas includes all public supply, irrigation, and industrial wells, and a representative number of domestic and livestock wells. The principal aquifers are the Blaine Formation of Permian age and the alluvial plain, terrace, and channel deposits of Quaternary age. The Blaine Formation yields small to large quantities of saline water (494 to 4,482 milligrams per liter of dissolved solids) to wells and is capable, in places where solution cavities are interconnected, of yielding more than 1,000 gallons per minute. Although the water is of poor quality, the Blaine is the major source of irrigation water in the county. The Quaternary alluvium yields small to large quantities of water that is generally low in dissolved solids, and is the major source of water for municipal supply. Water levels in the aquifers have remained generally steady since about 1938, except in a few areas of concentrated pumpage for irrigation. The major water quality problems in Collingsworth County are the concentrations of dissolved solids, sulfate, chloride, and sodium. No evidence was found of groundwater pollution from oil-field brines. (Woodard-USGS)
W71-03935

GEOLOGY AND GROUNDWATER RESOURCES OF ALLEN COUNTY, KANSAS,
Kansas State Geological Survey, Lawrence.
Don E. Miller.
Kansas Geological Survey Bulletin 195, December 1969. 50 p, 14 fig, 1 plate, 5 tab, 63 ref.

Descriptors: *Groundwater, *Water wells, *Water resources, *Geology, *Kansas, Hydrologic data, Water quality, Aquifers, Aquifer characteristics, Logging (Recording), Data collections, Water levels, Sediments, Water table, Springs, Water yield, Hydrogeology, Chemical analysis, Water utilization, Drawdown, Pumping, Specific capacity.
Identifiers: *Groundwater hydrology, Allen County, Kansas.

Allen County, Kansas, lies within the Osage Plains section of the Central Lowlands physiographic province and includes an area of about 504 square miles. Rocks above the Precambrian basement have an average thickness of about 2,000 feet and are all sedimentary in origin. The consolidated deposits range in age from Cambrian through Pennsylvanian, and the unconsolidated deposits range in age from probable Tertiary through Quaternary. The most important bedrock aquifers are the shallow Pennsylvanian limestones and sandstones that have been weathered along joints, fractures, and bedding planes. Potable groundwater is usually not found in the county below the base of the Kansas City Group, and in many places the boundary between fresh and saline water is much higher in the stratigraphic section. Alluvial deposits having an average thickness of about 25 feet in the Neosho River valley should yield 10 to 100 gallons per minute of groundwater to wells. Water from the Quaternary deposits is of good quality but is usually very hard. Water derived from shallow bedrock aquifers is generally higher in dissolved solids content and hardness than water from the Quaternary deposits. (Woodard-USGS)
W71-03937

USE OF PORE CASTS AND SCANNING ELECTRON MICROSCOPE TO STUDY PORE GEOMETRY,
Pan American Petroleum Corp., Tulsa, Okla. Research Center.
For primary bibliographic entry see Field 07B.
W71-03946

REMOTE GROUNDWATER LEVEL METER FOR BOG STATIONS,
For primary bibliographic entry see Field 07B.
W71-03966

COMPUTER AIDS GROUNDWATER RESOURCES RESEARCH PROJECT,
Arizona Univ., Tucson. Dept. of Agricultural Engineering.
W. G. Matlock, and P. R. Davis.
Progressive Agriculture in Arizona, Vol 22, No 5, Sept-Oct 1970, p 3-5. 4 fig.

Descriptors: *Computer programs, *Groundwater, *Digital computers, *Water resources, *Data collections, Data processing, Data storage and retrieval, Water level fluctuation, Withdrawal, Maps, Consumptive use, Wells, Logging (Recording), Contours, On-site data collections, Depth, Research equipment, Measurement, Surveys.
Identifiers: *Data bank, Printout, Punchcards.

Digital computer programs were written to meet groundwater resources research requirements because of prompt data storage and retrieval, fulfillment of data-user needs, mapping possibilities and adaptability. Groundwater research in the Agricultural Engineering Department of the University of Arizona began in the early 1900's, as the importance of groundwater to Arizona was recognized early. Thus, there are records for over 70 years of field work. Basic groundwater data collected periodically includes water-level measurements, pumpage and consumptive use inventories, domestic and industrial use measurements, water quality, sampling chemistry and temperature, maintenance of drillers' well logs and specialized studies. The Santa Cruz Valley from Nogales to Picacho Peak, the Avra and Altar Valleys and Little Chino Valley are presently under study. Preparation of yearly groundwater contour and water-level change maps, which used to take several months, is now done by computer program. Data is card-punched, and programs print out tables for office and inquiry use, hydrographs and crop-survey summaries. Programs make groundwater information available, with considerable error reduction, for class projects, graduate theses, consulting engineers, groundwater geologists, real estate agents, water users and government agencies. Some of the computer output may be used directly in publication. (Popkin-Arizona)
W71-04057

NEW CHART OFFERS FAST PERMEABILITY ESTIMATE,
California Univ., Berkeley.
For primary bibliographic entry see Field 07B.
W71-04110

GEOHYDROLOGIC BOUNDARY ENVELOPES,
Department of Energy, Mines and Resources, Calgary (Alberta). Inland Waters Branch; and Research Council of Alberta, Edmonton.
D. H. Lennox, and A. Vandenberg.
Journal of Hydrology, Vol 12, No 1, p 48-52, December 1970. 5 p, 2 fig, 2 ref.

Descriptors: *Groundwater movement, *Drawdown, *Unsteady flow, Mathematical studies, Transmissivity, Storage coefficient, Observation wells, Water wells.
Identifiers: *Envelopes (Mathematical), *Aquifer testing, *Pumping tests, *Theory of images.

Analysis of drawdown data for an observation well in a semi-infinite aquifer gives a one-parameter family of straight lines, each of which, in the absence of supplementary geologic or hydrologic evidence, defines a possible boundary location. The curve to which all members of the family are tangent is an ellipse and is called to geohydrologic boundary envelope. This ellipse may be useful in considering the significance of nonresponsive observation wells or in using supplementary geologic data to determine the position of a boundary. (Knapp-USGS)
W71-04125

FINITE AQUIFERS: CHARACTERISTIC RESPONSES AND APPLICATIONS,
C. Venetis.
Journal of Hydrology, Vol 12, No 1, p 53-62, December 1970. 10 p, 5 fig, 3 tab, 3 ref.

Descriptors: *Groundwater movement, *Water level fluctuations, *Simulation analysis, *Input-output analysis, Mathematical models, Numerical analysis, Synthetic hydrology, Water levels, Equations, Flow, Porous media, Analog models, Aquifers.
Identifiers: Finite aquifers.

The response to characteristic piezometric height inputs of aquifers of finite dimensions is examined using linear differential equations of groundwater flow. In practical applications the response to characteristic inputs may be used in input-output analysis and synthesis for prediction of piezometric heights and estimation of the parameters of aquifers as well as in setting up and testing groundwater analog models. Such applications are illustrated by a simple numerical example. (Knapp-USGS)
W71-04126

ANALYTICAL SOLUTION OF THE LAPLACE EQUATION IN REGIONAL GROUNDWATER FLOW FIELD,
Arya Mehr Industrial Univ., Tehran (Iran). Dept. of Mechanical Engineering.
Mohsen Shahbazi.
Text also in French. Journal of Hydraulic Research, Vol 8, No 4, p 457-476, 1970. 20 p, 17 fig, 12 ref.

Descriptors: *Groundwater movement, *Laplaces equation, Porous media, Permeability, Model studies, Mapping, Hydraulic models, Least squares method, Flow nets, Aquifers, Groundwater basins.
Identifiers: Groundwater flow fields.

The Laplace equation was solved analytically for single and multi-layered systems in a regional groundwater flow field with the aid of conformal mapping and separation of variables. The results for one layered system were checked with laboratory experiments using the Hele-Shaw model. Also for multi-layered systems and for some single-layered ones, the results were shown to be in good agreement with another independent method of solution using the least-square method. (Knapp-USGS)
W71-04130

THE PUMPED WELL,
Colorado Agricultural Experiment Station, Fort Collins.
For primary bibliographic entry see Field 04B.
W71-04292

2G. Water in Soils

ADSORPTION OF BORON BY FERROMAGNESIAN MINERALS AND MAGNESIUM HYDROXIDE,
Agricultural Research Service, Riverside, Calif. Soil and Water Conservation Research Div.
J. D. Rhoades, R. D. Ingvalson, and J. T. Hatcher.
Soil Science Society America Proceedings, Vol 34, No 6, p 938-941, November-December 1970. 4 p, 1 fig, 5 tab, 10 ref.

Descriptors: *Soil chemistry, *Boron, *Adsorption, *Soils, Magnesium hydroxide, Leaching, Clays, Silts, Sands, Clay minerals, Particle size, Chemical analysis, Soil water, Profiles, Silicates, Soil properties, Test procedures, Methodology, Temperature, Mineralogy, X-Ray diffraction.
Identifiers: *Ferromagnesian minerals.

Arid-zone soils are found to have appreciable boron-sorption capacities in their silt and sand fractions. The site of this sorption is hypothesized to be magnesium-hydroxy clusters and coatings that exist on the weathering surfaces of ferromagnesian minerals such as olivine, enstatite, diopside, augite, tremolite, and hornblende as well as micaceous layer-silicate minerals. The boron-adsorption capacities of the nine soils used were determined by evaluating the Langmuir adsorption coefficients of the soils after their native sorbed boron had been removed by extraction with a mannitol-calcium-chloride solution and after they had been separated into particle-size fractions. Data for a representative soil show that out of the soil's total boron-sorption capacity of 10.8 mg/kg, 7.7 mg/kg reside in the non-clay fraction. The percentages of boron-sorption capacity residing in the non-clay fractions ranged from 25 to 90. Thus, it is apparent that soils may contain minerals other than clay-sized minerals with their associated iron- and alluminum-hydroxy coatings that are capable of sorbing appreciable amounts of boron. (Woodard-USGS)
W71-03939

PEDOGENIC DISTRIBUTION OF ZINC IN MOLLISOLS AND ASSOCIATED ENTISOLS IN NEBRASKA,
Nebraska Univ., Lincoln. Dept. of Agronomy.
Wayne N. Dankert, and James V. Drew.
Soil Science Society America Proceedings, Vol 34, No 6, p 916-919, November-December 1970. 4 p, 2 tab, 27 ref.

Descriptors: *Soil chemistry, *Clay loam, *Zinc, *Soil tests, *Nebraska, Distribution, Particle size,

Testing, Soil moisture, Test procedures, Soil profiles, Soil structure, Methodology, Spectrophotometry, Chemical analysis, Fine-textured soils, Carbonates, Organic matter, Silts, Plants, Sands, Adsorption, Loess, Mineralogy.
Identifiers: *Zinc distribution (Soils), Clay illuviation, Soil genesis.

The distribution of total Zn in a Udic Haplustoll (Moody) and a Typic Argiustoll (Holdrege) formed in Peoria loess in Nebraska is related to the accumulation of illuvial clay in these soils. In Typic Ustorthents (Crofton and Coly) formed in Peoria loess, a comparable distribution of noncarbonate clay and total Zn does not occur. Larger amounts of Zn in noncarbonate clay from the upper sola of the four profiles, than in noncarbonate clay from their C horizons, suggest that Zn is released from soil minerals and cycled by vegetation during biopedogenic weathering, then becomes associated with noncarbonate clay in the A horizons following decomposition of plant residues. In Moody and Holdrege, however, maximum amounts of Zn in the total soil occur in the B horizons of clay maxima, suggesting that Zn moves in association with clay from the A to the B horizons during the genesis of these soils. (Woodard-USGS)
W71-03940

SOLUBILITY AND AVAILABILITY OF SORBED SULFATE IN HAWAIIAN SOILS,
Hawaii Univ., Honolulu. Dept. of Agronomy and Soil Science.
S. M. Hasan, R. L. Fox, and C. C. Boyd.
Soil Science Society America Proceedings, Vol 34, No 6, p 897-901, November-December 1970. 5 p, 6 fig, 5 tab, 24 ref.

Descriptors: *Soil chemistry, *Sulfates, *Sorption, *Soils, *Hawaii, Soil water, Solubility, Retention, Adsorption, Ionization, Anion exchange, Sulfur, Rain water, Plants, Fertilizers, Solubility, Chemical analysis, Rainfall, Soil properties, Mineralogy, Test procedures, Turbidity, Soil-water-plant relationships, Soil profiles, Crop response.
Identifiers: *Volcanic ash soils (Hawaii), Sulfate adsorption, Kikuyu grass.

The capacity of volcanic ash soils to adsorb sulfate is related to rainfall, a major factor in weathering. Highly weathered and leached soils developed from ash may contain 7000 micrograms per gram of sulfate as sulfur in the subsoil. This sulfate has very low water solubility. Some less weathered ash soils are almost devoid of sulfates. Desorption of sulfate decreases the solubility of adsorbed sulfate remaining. Sulfate sorption-desorption isotherms plotted against log concentration of sulfate in equilibrium solutions give approximately straight lines up to 16 to 30 ppm sulfur in solution. Indications are that 'first phase' adsorption maxima were attained at about 33 ppm sulfur in solution. Pot studies on soils which sorb much sulfate indicate that the soil solution should contain about 5 ppm sulfate for adequate nutrition of kikuyu grass. This corresponds to 60 to 80% of first phase adsorption maxima of the ash derived soils. Soils which have low capacity to adsorb sulfate need higher concentrations of sulfate in solution to compensate for low adsorption capacity. A soil which field experiments had shown to be very deficient in sulfur was only 10% sulfate saturated. (Woodard-USGS)
W71-03941

THE DIFFUSION OF COPPER, MANGANESE, AND ZINC AS AFFECTED BY CONCENTRATION, CLAY MINERALOGY, AND ASSOCIATED ANIONS,
Kentucky Univ., Lexington. Dept. of Agronomy.
J. H. Ellis, R. I. Barnhisel, and R. E. Phillips.
Soil Science Society America Proceedings, Vol 34, No 6, p 866-870, November-December 1970. 5 p, 5 fig, 1 tab, 13 ref.

Descriptors: *Soil chemistry, *Clay minerals, *Diffusion, *Cation adsorption, *Soil water, Diffusivity, Copper, Manganese, Illite, Kaolinite, Montmorillonite, X-ray spectroscopy, Equations, Theoretical analysis, Ionization, Ions, Adsorption, Plants, Root systems, Mineralogy.
Identifiers: Diffusion coefficients, Zinc.

The distributions of Cu, Mn, and Zn diffusing in thin oriented clay films of water-saturated montmorillonite, vermiculite, illite and kaolinite were obtained using a miniature probe attachment for an X-ray emission spectrometer. Diffusion coefficients were calculated from these experimental distributions. Only small differences in the diffusion coefficients of Cu, Mn, and Zn at comparable concentrations were found for a given clay. The range of diffusion coefficients for copper chloride was 0.17 millionths of a sq. cm. per sec. of vermiculite clay to 5.21 of kaolinite. The diffusion rates of copper, manganese, and zinc through the clay minerals were of the order from greatest to least: kaolinite, illite, montmorillonite, and vermiculite. Some estimates of the diffusion coefficients in the liquid phase and in the adsorbed phase are given. (Woodard-USGS)
W71-03942

INVESTIGATION OF THE WATER REGIME OF SOILS IN THE AERATION ZONE, THEIR FREEZING, WATER-PHYSICAL AND FILTRATION PROPERTIES,
A. A. Kapotov.
Translated from Trudy Gos Gidrol Inst-ta, No 176, p 70-107, 1969. Soviet Hydrology: Selected Papers, No 5, p 456-479, 1969. 24 p, 8 fig, 9 tab, 23 ref, 3 append.

Descriptors: *Soil moisture, *Freezing, *Thawing, *Soil physical properties, *Soil water movement, Filtration, Percolation, Frost, Snowpacks, Regime, Porosity, Moisture content, Water storage, Bulk density, Surveys, Data collections, Hydrologic data.
Identifiers: *USSR, *Valdai Hydrologic Laboratory (USSR).

Extensive data have been collected by the Valdai Laboratory of some water-physical properties of soils, their water regime, depth of freezing, and filtration properties for a relatively large area of the USSR. The area where the Laboratory made its investigations is a morainic landscape with hills, ridges, and waterlogged depressions. Dry valleys occupy an average of 80% of the total catchment areas. The surface of the catchments is composed of a layer of Quaternary glacial deposits 20-50 m thick. The lithological composition varies both in the horizontal and vertical directions. The soil hydrophysical data are summarized graphically and statistically. Graphs relate bulk density to moisture content, water storage distribution to depth, texture to physical property, freezing depth to snow depth, and absorption of depth. Tabular data include porosity, moisture content, water storage, freezing depths, snow cover, absorption and filtration characteristics, bulk density, and annual water storage records. (Knapp-USGS)
W71-03964

LITERATURE SURVEY OF MOISTURE MIGRATION IN SOILS DUE TO THERMAL GRADIENTS,
Northwestern Univ., Evanston, Ill. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02C.
W71-04000

DETERMINATION OF SOIL PERMEABILITY BY THE METHOD OF LARGE RINGS,
Bureau of Reclamation, Denver, Colo.
V. E. Rainin, and E. A. Makarycheva.
Translated from: Gidrotekhnika i Melioratsiya No 1, p 34-48, 1965. Available from NTIS as PB-193 618T, $3.00 in paper copy, $0.95 in microfiche. Bureau of Reclamation Translation No 686, April 1967. 11 p, 2 fig, 1 tab.

Descriptors: Water, *Permeability, Soils, Soil mechanics, Soil moisture, Soil physical properties, Field tests, Seepage, Test procedures, Groundwater, Velocity, Measurement, Neutron counters, Meters, Observation wells, Drill holes, Wet condition.
Identifiers: Seepage rings method, *Wetting front, Foreign, Research, USSR, Soil moisture movement, Golodnaia Steppe (USSR).

USSR hydraulic engineers have checked an American method for determining soil permeability and seepage rates by large concentric rings and recommended its use because of its reliability, especially in layered soils. Other advantages of this method are that it uses Nesterov's principles for large wetted surfaces, familiar to Soviet soil specialists; the test arrangement is simple to set up and measurements are made easily; and it is capable of automation. Disadvantages are the longer time required for observations and the large quantity of water used. Seepage measurements were conducted on several test plots in the Golodnaia Steppe of Central Asia over a 3-year period. The 2.6-m-dia metal inner ring set in a 10-cm furrow and the 7.8-m-dia earth outer ring faced with polyethylene film automatically were kept filled with water to a constant depth of 30 cm. Soil moisture was measured by neutron meters inserted into observation drill holes. Before-and-after measurements permitted fixing changes in the position of the wetting front, and with time, computing the wetting and seepage rates horizontally and vertically. Tests showed that wetting rate was at first greater than seepage; but later they became approximately equal and the curves became flat slopes, indicating a stable seepage rate.
W71-04006

DRAINAGE LINE DEPTH,
Bureau of Reclamation, Denver, Colo.
For primary bibliographic entry see Field 08D.
W71-04016

IMPROVING EFFICIENCY IN AGRICULTURAL WATER USE,
Colorado State Univ., Fort Collins. Natural Resources Center.
For primary bibliographic entry see Field 03C.
W71-04049

SOME ASPECTS OF THE GEOMORPHOLOGY OF THE AIR MOUNTAINS, SOUTHERN SAHARA,
Ahmadu Bello Univ., Zaria (Nigeria). Dept. of Geography.
M. B. Thorp.
Institute of British Geographers, Transactions, No 47, p 25-46, September 1969. 12 fig, 33 ref.

Descriptors: *Geomorphology, *Deserts, *Aggradation, *Canyons, *Land forming, Arid lands, Superimposed drainage, Drainage density, Geologic time, Mountains, Regions, Slopes, Sedimentary basins (Geological), Structural geology, Topography, Volcanoes, Weathering, Water gaps, On-site investigations, Geological surveys, Sediments, Stratigraphy, Tropical regions, Erosion, Tertiary Period, Granites, Crystalline rocks, Elevation, Rainfall, Vegetation, Temperature, Lava, Sedimentary rocks, Environmental effects, Sandstones, Deformation, Paleoclimatology, Paleohydrology, Mode of action, Mineralogy, History, Pleistocene Epoch, Terraces (Geological), Gravels, Climates.
Identifiers: *Air Mountains, *Sahara Desert, *Niger, *Planation surfaces, *Massifs, Morphoclimatic aspects, Pluvial effects, Pediplanation, Regs, Escarpments, Tectonic granites, Gneisses, Wadis, Climatic effects, Outcrops.

The Air Mountains are remote mountain 'islands' of the Sahara and contain many features of considerable geological and geographical interest hidden, unfortunately, by their isolation. The three salient geomorphological features of the region are planation surfaces, morphology, of the Jurassic

granite massifs and pleistocene aggradational land forms. The author feels that despite criticism of the evolutionary approach to landform analysis, it may be useful and valid in this region. The climate, relief and drainage patterns of the area are discussed. Granitic and metamorphic crystalline basement rocks are surrounded by Carboniferous to Cretaceous sediments and are frequently overlain by end-Cretaceous lavas. Much evidence suggests that the crystalline rocks were buried during the Cretaceous marine transgression. The major koris (wadis) are discordant to the crystalline and in one section the koris from the crystalline area cut through the sedimentary scarplands as consequent streams in water gaps. The dominant feature of the Air is a planation surface having a relative relief of 10-100 m. The main Air surface is Tertiary in age while the summit surface is either Cretaceous or Palaeocene. The differential erosion of various granites in the Timia Jurassic granite ring complex is emphasized and it appears that these processes are similar to those of the now humid Nigerian massifs. Tertiary denudation in the 2 regions was probably similar and Tertiary climates in the southern Sahara were probably more humid than now. Climate was also important in the formation of Pleistocene aggradational landforms. It is felt that the opening and closing phases of pluvial periods produced phases of kori incision and aggradation. (Casey-Arizona)
W71-04050

SOME PROBLEMS OF A KARST AREA IN THE EASTERN TRANSVAAL, SOUTH AFRICA,
University of the Witwatersrand, Johannesburg (South Africa). Dept. of Geography.
Margaret E. Marker.
Institute of British Geographers, Transactions, No 50, p 73-85, July 1970. 6 fig, 3 tab, 18 ref.

Descriptors: *Karst, *Geomorphology, *Drainage effects, *Dolomite, *Sedimentary structures, On-site investigations, Seepage, Alluvium, Terraces (Geological), Basins, Weathering, Valleys, Mode of action, Sedimentary rocks, Stratigraphy, Erosion, Chemical analysis, Calcium, Magnesium, Runoff, Bedrock, History, Caves, Slopes, Land forming, Geologic time, Environmental effects, Pleistocene Epoch, Interfluves, Geologic formations.
Identifiers: *South Africa, *Transvaal, *Relict structures, Hythergraphs, Intrusions.

The geomorphology of certain areas of the Pre-Cambrian Dolomites of the Transvaal system of South Africa suggest the operation of karst processes. In describing the karst topography, 3 distinct aspects of the landscape are considered: (1) origin and shape of the conical dolomite hills found along the interfluves which seem to be a form of Kegel karst, (2) the wide, flat-floored valleys, which were probably formed by lateral sapping of springs, floods or runoff and (3) the sedimentary infill of the valleys which form terraces of highly weathered alluvial deposits and which are considered relicts. The interfluves are reminiscent of cone karst and the basins represent a karst plain with insoluble floors, some fault control and a deep alluvial infill. Degraded slopes, collapsed caves and rotten infill combine with the other evidence to suggest that past processes created the land forms which may be described as relict karst. Probably active karstification occurred during warmer, more humid periods of the Pleistocene. (Casey-Arizona)
W71-04053

MINERALOGY OF SOME ARID AND SEMIARID LAND SOILS OF IRAQ,
Wisconsin Univ., Madison. Geological and Natural History Survey.
A. H. Al-Rawi, M. L. Jackson, and F. D. Hole.
Soil Science, Vol 107, No 6, June 1969, p 480-486. 2 tab, 5 fig, 24 ref.

Descriptors: *Mineralogy, *Sierozems, *Soil analysis, *Soil formation, *Alluvium, *Soil water, Montmorillonite, Crop production, Deserts, Arid lands, Arable land, Brown soils, Soil physical properties, Hydraulic conductivity, Clays, Quartz, Sands, Silts, Particle size, Land development, Terraces (Geological), Semiarid climates, Pleistocene Epoch, Quaternary Period, Fine-texture soils, Soil types.
Identifiers: *Iraq, *Semiarid lands, *Land use capabilities, Haplargrid soil, Torrifluvent soil, Xerothermic interval, Quaternary pedology, Holocene alluvium, Feldspars.

Deserts, widespread during the Xerothermic Interval (6000 to 4000 yrs. B.P.), occupy a third of the earth's land area, including most arable land of Iraq. Understanding the composition of these soils is important for advances in Quaternary pedology and for food production in arid lands. This quantitative mineralogical analysis of one Haplargid (Brown) soil (Pleistocene terraces of northern Iraq), and three Torrifluvent (Alluvial) soils (stratified, fine textured Holocene alluvium of north and central Iraq) provides a means of understanding soil formation and properties, and land use capabilities (alkalinity, nutrients, salinity). Montmorillonite, important to hydraulic conductivity, is the dominant clay, the remaining minerals being mica, vermiculite, quartz, feldspars and stratified silicates with chlorite and mica. Quartz is the dominant sand and silt mineral, the remainder being albite, microcline, mica, vermiculite, chlorite, montmorillonite, and traces of serpentine, amphibole, sepiolite, palygorskite and kaolinite. Mineral ratios are discussed. Quartz and feldspars decrease, while montmorillonite, mica and vermiculite increase with decreasing particle size. Haplargid and two Torrifluvent surface horizons had uniform mineralogy. Tables include soil formation factors of some great soils and feldspar contents and ratios. Figures show soil locations, sand and soil mineralogy and X-ray diffractograms of clay and mica. (Popkin-Arizona)
W71-04061

SATURATION-UNSATURATION TRANSITION IN INFILTRATION TO A NON-UNIFORM SOIL PROFILE,
Technion--Israel Inst. of Tech., Haifa.
Dan Zaslavsky.
Soil Science, Vol 107, No 3, March 1969, p 160-165. 5 fig, 9 ref, 15 equations.

Descriptors: *Saturated flow, *Unsaturated flow, *Infiltration, *Soil water movement, *Flow resistance, Hydraulic conductivity, Flow profiles, Groundwater, Interfaces, Infiltrometers, Soil surfaces, Reservoir leakage, Artificial recharge, Resistance, Arid lands, Equations, Flow rates, Pressure head, Soil physical properties, Permeability, Depth, Measurement, Control.
Identifiers: *Control surface layer, *Vertical flow, 2-dimensional flow, 3-dimensional flow, Water head, Circumference buffering, Infiltration ring.

Transition from saturated to unsaturated flow, flow profile analysis with depth to groundwater, and hydraulic conductivity as a depth function were studied. Groundwater does not influence the infiltration rate unless it comes very near the interface between layers. Infiltration rate is proportional to ponded water head only at high heads. With a control surface layer, infiltration ring measurements need no circumference buffering to preserve vertical flow. It is necessary that the ring walls be pushed through the less permeable surface layer. Infiltration rate is unaffected by the flow divergence below the control layer. When the top layer is much more permeable, it is impossible to form a vertical downward flow under a limited infiltration area, and the overall infiltration rate will decrease with increase in wetted soil surface. The control layer concept can be qualitatively extended to 2 and 3 dimensional flow. Flow resistance along a stream tube decreases with increased distance from point of entry. One figure enables one to define some equivalent flow resistance layer and an equivalent hydraulic conductivity. This approach is useful for evaluating reservoir leakage with complex topography and for computing infiltration rates in areas of artificial groundwater recharge. Figures show pressure head and distribution in unsaturated flow, transition heads, experimental and theoretical infiltration rates, and unsaturated soil portion as a head function. (Popkin-Arizona)
W71-04066

MOVEMENT OF ALGAL- AND FUNGAL-BOUND RADIOSTRONTUM AS CHELATE COMPLEXES IN A CALCAREOUS SOIL,
Arizona Univ., Tucson.
For primary bibliographic entry see Field 05B.
W71-04067

MICROBIAL POPULATIONS IN STUBBLE-MULCHED SOIL,
Agricultural Research Service. Northern Plains Branch; and Nebraska Univ., Lincoln. Agricultural Experiment Station.
Fred A. Norstadt, and T. M. McCalla.
Soil Science, Vol 107, No 3, March 1969, p 188-193. 4 tab, 2 fig, 13 ref.

Descriptors: *Stubble mulching, *Bacteria, *Fungi, *Nebraska, *Microorganisms, Wheat, Actinomycetes, Crop production, Soil moisture, Erosion, Permeability, Drainage, Root zone, Loess, Sampling, Cultivation, Rotations, Soil microbiology.
Identifiers: *Microbial populations, *Subtilling, *Penicillium, *Trichoderma, *Patulin, Residues, Semiarid lands.

The purpose of this paper is to consider the numbers of Penicillium urticae Bainier and Trichoderma sp. P. urticae B., total bacterial and fungal counts, and patulin amounts in stubble-mulched soil at three east-to-west locations across Nebraska. Soil samples were obtained from Lincoln, North Platte and Alliance, Nebraska. Soils at the sites were on Peorian loess and have deep root zones, good internal and surface drainage, and moderate permeability. Rotations were established to study stubble mulching in relation to erosion, moisture storage and crop yields. Subtilling increased total bacterial actinomycetes and fungi. P. urticae B. numbers increased in subtilled compared with plowed soil or with subtilled soil with removed crop residue. Subtilling did not increase Trichoderma sp. Growth of associated microorganisms changed wheat straw into a favorable substrate for P. urticae B. P. urticae B. numbers were highest in spring and fall, and lowest in summer in subtilled soil, whereas Trichoderma sp. numbers were reversed in this trend. The anatagonism of P. urticae B. to Trichoderma mediated by patulin could cause this inverse trend. Patulin was detected in field samples at 1.5 ppm in soil and 40 to 75 ppm in wheat straw residue. Yield reduction with subtilling could be partially due to patulin production. Tables and figures quantify these relations. (Popkin-Arizona)
W71-04068

SIMILITUDE CONCEPT IN PARTIALLY SATURATED SOILS,
Regional Inst. of Tech., Jamshedpur (India). Dept. of Applied Mechanics.
S. V. Kameswara Sarma.
Text also in French. Journal of Hydraulic Research, Vol 8, No 4, p 477-492, 1970. 16 p, 4 fig, 2 tab, 4 ref.

Descriptors: *Hydraulic models, *Soil water movement, *Hydraulic similitude, Saturated flow, Unsaturated flow, Seepage, Model studies, Mathematical studies, Capillary action, Diffusivity, Canal seepage, Dams.
Identifiers: *Partially saturated flow.

Linear scale ratios were established for partially saturated steady and unsteady states of flow in soils. These deductions were verified for two-dimensional flows through earth dams and canals. The results obtained from experimental investiga-

tion on graded sand models agree closely with theoretical deductions made for steady flow phenomena. They differed for unsteady saturated fronts because diffusivity was not simulated to scale. (Knapp-USGS)
W71-04131

WATER MOVEMENT IN THE UNSATURATED ZONE OF HIGH AND LOW PERMEABILITY STRATA BY MEASURING NATURAL TRITIUM,
Atomic Energy Research Establishment, Wantage (England). Research Lab.; Water Resources Board, Reading (England); and Hydrological Research Unit, Wallingford (England).
For primary bibliographic entry see Field 02A.
W71-04138

SOIL MOISTURE DEPLETION AND ESTIMATED EVAPOTRANSPIRATION ON UTAH MOUNTAIN WATERSHED,
Forest Service (USDA), Ogden, Utah. Intermountain Forest and Range Experiment Station.
For primary bibliographic entry see Field 02D.
W71-04242

HALF-MINUTE COUNTS FOR NEUTRON PROBES,
Forest Service (USDA), Fayetteville, Ark. Southern Forest Experiment Station.
For primary bibliographic entry see Field 07B.
W71-04259

INFILTRATION AND SOIL EROSION AS INFLUENCED BY VEGETATION AND SOIL IN NORTHERN UTAH,
Forest Service (USDA), Reno, Nev. Intermountain Forest and Range Experiment Station.
For primary bibliographic entry see Field 02J.
W71-04260

INFILTRATION AND SOIL EROSION ON COOLWATER RIDGE, IDAHO,
Forest Service (USDA), Reno, Nev. Intermountain Forest and Range Experiment Station.
For primary bibliographic entry see Field 02J.
W71-04261

INFLUENCE OF MANAGEMENT AND ENVIRONMENTAL FACTORS ON EXTENT OF SOIL WATER DEPLETION BY SPRING WHEAT,
North Dakota State Univ., Fargo. Dept. of Soils.
For primary bibliographic entry see Field 03F.
W71-04303

2H. Lakes

GREAT LAKES SHORELAND MANAGEMENT AND EROSION DAMAGE CONTROL FOR MICHIGAN.
Michigan Water Resources Commission, Lansing. Dept. of Natural Resources.

Department of Natural Resources, WDS-4, January 1970. 18 p, 21 fig. Supported by a Water Resources Council Grant.

Descriptors: *Shore protection, *Erosion control, *Great Lakes, *Littoral drift, *Soil erosion, *Flood damage, Bank stability, Michigan, Lake shores, Lake Erie, Lake Michigan, Lake Huron, Seiches, Wind tides, Land management, Sediment control.
Identifiers: *Shoreland management.

A program has been developed and introduced to the Michigan Legislature to provide for the protection, effective management, and maintenance of the quality of the Great Lakes shorelands of Michigan. Included are provisions to: require zoning of shorelands; establish the responsibilities of the Department of Natural Resources and the Water Resources Commission; authorize engineering and special studies of the shorelands; and develop a comprehensive plan for the use of the shorelands. The shorelands of some of Michigan's southern counties are over 80 percent developed. Erosion is a natural process; however, when water levels are high and when high winds occur, damage can be severe. In addition to damages caused by normal weather during high water, there is a threat of short but violent fluctuations from seiches that can inundate large areas within minutes. Primary damage results from erosion of the shoreline, causing physical loss of land areas, trees, structures, docks, homes, cottages and roads. Accelerated sedimentation impairs water quality, increases domestic water treatment costs, destroys aquatic life and habitat, and fills river mouths. A shoreland management program should give first priority to assuring that new developments along the Great Lakes will not be subject to erosion effects. A partnership management program between the Michigan State government and local governments is suggested. (Poertner)
W71-03908

THE ROLE OF AQUATIC VASCULAR PLANTS IN THE EUTROPHICATION OF SELECTED LAKES IN WASTERN MASSACHUSETTS,
Massachusetts Univ., Amherst. Water Resources Research Center.
For primary bibliographic entry see Field 05C.
W71-03918

EUTROPHICATION OF WATER RESOURCES OF NEW YORK STATE, OBSERVATIONS ON NUTRIENT LIMITATION ON SUMMER PHYTOPLANKTON IN CAYUGA LAKE, 1967 AND 1968,
Cornell Univ., Ithaca, N.Y. Water Resources and Marine Sciences Center.
John P. Barlow, William Schaffner, and Virginia B. Scarlet.
Available from NTIS as PB-197 123, $3.00 in paper copy, $0.95 in microfiche. Technical Report 21, June, 1970. 16 p, 2 tab, 1 fig, 5 ref. OWRR Project No. A-007-NY (2).

Descriptors: *Nutrients, *Phytoplankton, *Stratification, Phosphates, Silicates, New York, Water pollution effects, Aquatic environment, Lakes.
Identifiers: *Cayuga Lake (N.Y.).

The role of nutrients in regulating phytoplankton populations remains a problem of central importance in aquatic ecology. It is of particular interest during the period of summer stratification. Cayuga Lake was used in this study since it is a favorable environment for investigating nutrient effects on phytoplankton. It is strongly stratified in the summer, and both phosphate and silicate are reduced to low levels, whereas nitrate remains relatively abundant. During 1966, Hamilton performed a series of nutrient enrichment experiments in which he tested effects of major nutrient elements on rates of 14-C uptake in short-term experiments. During the summers of 1967 and 1968 similar enrichment experiments were continued and were described here. Water samples for experiments and for nutrient and phytoplankton analyses were obtained from mid-lake between Portland Point and Taughannock Point for both years. Silicate and phosphate for the two summers were shown and compared to Hamilton's values for 1966. The phytoplankton populations were more difficult to compare. A total of seven experiments were completed in 1967 and the results were summarized. The following summer the experiments were modified and twelve additional experiments were then performed. The results of all nineteen experiments were then summarized. A discussion and comparison of the experiments of 1967 and 1968 followed.
W71-03923

A WINTER LIMNOLOGICAL STUDY OF LAKE WILCOX: A FRESHWATER IMPOUNDMENT,
Virginia State Coll., Petersburg. Dept. of Biology.
B. R. Woodson, and T. D. Atkinson.
Virginia Journal of Science, Vol 21, No 4, p 185-195, 1970. 11 p, 11 fig, 2 tab, 12 ref.

Descriptors: *Limnology, *Lakes, *Virginia, Winter, Aquatic environment, Biological properties, Chemical properties, Surface waters, Fresh water, Thermocline, Water chemistry, Hydrologic data, Data collections, Water temperature, Plankton, Zooplankton, Chemical analysis, Benthos, Tripton, Water quality.
Identifiers: *Lake Wilcox (Virginia).

A fourteen week winter limnological investigation was conducted on Lake Wilcox, Virginia from January 22 until April 23, 1969. The purpose of the study was to gain information concerning the winter populations of phytoplankton and zooplankton as well as the chemical and physical characteristics of the water. Plankton populations were generally negligible, with only a few different genera observed. Winter phytoplankton genera consisted mainly of diatoms, and zooplankton genera were primarily rotifers. A high allochthonous tripton load limited the Secchi-disc transparency to 0.8 m or less throughout the study. Iron was found in low quantities (1.0 to 3.5 ppm). Phosphates were generally low (0.06 to 0.25 ppm at surface, 0.06 to 0.23 ppm at 3m, and 0.06 to 0.29 ppm, benthic). Hydrogen-ion concentration and bicarbonate alkalinity showed Lake Wilcox to be neutral to slightly alkaline. Calcium was quite low with a maximum of 9.4 ppm during earlier sampling dates under winter conditions, and decreased to 3.3 ppm under spring conditions. (Woodard-USGS)
W71-03957

PREDICTION OF SOLAR AND ATMOSPHERIC RADIATION FOR ENERGY BUDGET STUDIES OF LAKES AND STREAMS,
Florida Univ., Gainsville. Dept. of Environmental Engineering.
For primary bibliographic entry see Field 02B.
W71-04020

QUANTITATIVE ASPECTS OF THE STUDY OF WATER BALANCES IN LAKES USING THE DEUTERIUM AND OXYGEN-18 CONCENTRATIONS IN THE WATER, (FRENCH),
Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
For primary bibliographic entry see Field 02A.
W71-04139

ENVIRONMENTAL ISOTOPE BALANCE OF LAKE TIBERIAS,
Weizmann Inst. of Science, Rehovoth (Israel).
For primary bibliographic entry see Field 02A.
W71-04140

STABLE ISOTOPES IN STUDY OF WATER BALANCE OF LAKE NEUSIEDL, AUSTRIA: INVESTIGATION OF THE RELIABILITY OF THE STABLE ISOTOPE METHOD,
Heidelberg Univ. (West Germany). Physikalisches Institut (II).
For primary bibliographic entry see Field 02A.
W71-04141

PERCH LAKE EVAPORATION STUDY,
Atomic Energy of Canada Ltd., Chalk River (Ontario). Chalk River Nuclear Labs.
For primary bibliographic entry see Field 02A.
W71-04142

HYDROGRAPH SYNTHESIS FOR WATERSHED SUBZONES FROM MEASURED URBAN PARAMETERS,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 04C.

W71-04184

2I. Water in Plants

INFLUENCE OF TEMPERATURE AND PHOTOPERIOD ON GROWTH, FOOD CONSUMPTION AND FOOD CONVERSION EFFICIENCY OF CHANNEL CATFISH,
Arkansas Univ., Fayetteville. Dept. of Zoology.
For primary bibliographic entry see Field 05C.
W71-03920

ECOLOGICAL SIGNIFICANCE OF ALIEN PLANTS IN CALIFORNIA GRASSLANDS,
California State Div. of Forestry, Sacramento.
For primary bibliographic entry see Field 04A.
W71-04233

MEASUREMENT OF WATER POTENTIAL WITH THERMOCOUPLE PSYCHROMETERS: CONSTRUCTION AND APPLICATIONS,
Forest Service (USDA), Logan, Utah. Intermountain Forest and Range Experiment Station.
Ray W. Brown.
USDA Forest Serv Res Pap INT-80, 1970. 27 p.

Descriptors: *Water measurement, *Moisture stress, *Water loss, *Soil-water-plant relationships, *Moisture tension, *Soil moisture meters, *Soil water, Plant physiology, Soil moisture retention, Soil physics, Soil water movement, Wilting point, Free energy, Equilibrium, Hygrometry, Utah.
Identifiers: *Thermocouple psychrometers, *Soil water potential, *Plant water potential, Soil-plant-atmosphere continuum, *Plant-water relations, *Soil water relations.

The use and construction of the thermocouple psychrometer for measurements of soil and plant water potential are discussed. The effects of ceramic and screen protective cups on the rates of water vapor exchange between the soil mass and the psychrometer cavity are compared. The ceramic cup imposes a much greater resistance to vapor exchange than the screen cups; the magnitudes of possible errors resulting from this resistance in estimates of water potential are discussed. Possible uses of thermocouple psychrometers for measuring water potentials of soils and plants under intensive forest management practices are considered. (Brown-Forest Service)
W71-04237

WATER POTENTIAL MEASUREMENTS IN TRESS,
Forest Service (USDA), Logan, Utah. Intermountain Forest and Range Experiment Station.
Herman H. Wiebe, Ray W. Brown, T. W. Daniel, and Eric Campbell.
BioScience Vol 20, No 4, p 225-226, February 15, 1970.

Descriptors: *Water measurement, *Moisture stress, *Water loss, *Soil-water-plant relationships, *Moisture tension, Transpiration, Mositure availability, Water balance, Trees, Soil water movement, *Soil water, Soil moisture meters, Plant physiology, Utah.
Identifiers: *Thermocouple psychrometers, *Water potential, Soil-plant-atmosphere contiuum, Water potential gradients, Plant water stress, *Plant water relations.

Water potentials of trees growing under natural conditions were measured in situ with thermocouple psychrometers. Miniature models of psychrometers used in soil research were inserted in holes drilled into the outer xylem of tree trunks and branches as small as 2 cm diameters. (The psychrometers had been calibrated at different temperatures in solutions of known osmotic value, and these calibrations were used in calculating the water potential from the psychrometer readings.) Water potentials decreased with increasing distance from the roots; they were also lower on hot, dry days than on rainy days or at night. Water potentials of twigs, determined with the pressure chamber technique, were always lower than those of the respective branches, while water potentials of leaf sections determined with a laboratory psychrometer were even lower. These studies confirm a continuous gradient of decreasing water potential from soil to trunk, branches, twigs and leaves. The branches studied were within 2 m of the ground, and the gradients were probably caused by resistance within the trees rather than altitudinal differences. The three methods agreed with each other, and can be used for measuring water potentials in situ in the entire soil-plant-leaf system. (Brown-Forest Service)
W71-04238

LEAF SAMPLER FOR RELATIVE WATER CONTENT MEASUREMENTS: DESIGN AND APPLICATION,
Forest Service (USDA), Logan, Utah. Intermountain Forest and Range Experiment Station.
Ray W. Brown.
Agronomy Journal, Vol 61, p 644-647, July-August 1969.

Descriptors: *Moisture content, *Soil-water-plant relationships, Water balance, *Water loss, *Wilting point, *Bouyoucos blocks, *Moisture availability, *Moisture stress, *Moisture tension, Soil moisture meters, Soil moisture, Wilting, Transpiration, *Water measurement, Utah.
Identifiers: Relative water content, Leaf cutter, Relative turgidity.

A leaf sampler capable of holding eight samples has been designed and used for measuring the relative water content of plant tissues. The precision-made leaf cutter and sample chambers permit the collection of leaf tissue disks from leaves still attached to the plant. After excision, tissue samples can be sealed immediately in small vials within the sample chambers to prevent evaporative water loss. Relative water content values of orchardgrass leaf samples obtained with the leaf sampler were higher, without exception, than were the values of similar samples obtained with a cork borer. However, these differences were not significant until permanent wilting was approached. (Brown-Forest Service)
W71-04239

ASPEN SPROUT PRODUCTION AND WATER USE,
Forest Service (USDA), Ogden, Utah. Intermountain Forest and Range Experiment Station.
Robert S. Johnston.
USDA, Forest Serv Res Note INT-89, 1969. 6 p, 3 fig, 3 tab.

Descriptors: *Water loss, *Soil water, *Evapotranspiration control, Soil moisture, Soil water, Nuclear moisture meters, Soil moisture meters, Forest management, Watershed management, Vegetation effects, Mountain forest, Utah.
Identifiers: Aspen trees.

Sprouting response and soil moisture depletion on aspen plots were compared under four experimental conditions: (a) clearcut, (b) clearcut, stumps sprayed with sodium arsenite, (c) basal injection of sodium arsenite, and (d) control. Numbers of sprouts varied with treatment for 2 years, but after 4 years the numbers of sprouts on all plots were about equal. Clearcutting the aspen reduced soil moisture depletion by 3 to 4 inches in a 6-foot soil profile during each of three growing seasons. (Johnston-Forest Service)
W71-04241

FORMATION OF PHYTOGENIC HILLOCKS II. ROOTING HABIT OF PLANTS FORMING PHYTOGENIC HILLOCKS,
Cario Univ., Giza (Egypt). Faculty of Science; and Ministry of Agriculture, Cairo (Egypt). Soil Research Dept.
K. H. Batanouny, and M. H. Batanouny.
Acta Botanica Academiae Scientiarum Hungaricae, Vol 15, No 1-2, p 1-18, 1969. 14 fig, 8 ref.

Descriptors: *Root development, *Xerophytes, *Halophytes, *Physiological ecology, *Soil-water-plant relationships, Arid lands, Salt marshes, Soil water, Grasses, Soil physical properties, Water utilization, Monocots, Dicots, On-site investigations, Root systems, Root distribution, Plant growth, Environmental effects, Saline water, Root zones, Deserts, Sands.
Identifiers: *Egypt, *Adventitious roots, *Phytogenic hillocks, Shoots.

A number of arid zone plant species growing in deserts, coastal dunes and salt marshes are able to form phytogenic mounds. During or after the formation of the mounds, root and shoot modifications occur. Particularly outstanding is the development of adventitious roots. In an effort to describe in detail and discover the physiological significance of these structural changes, 7 Egyptian species were investigated: Artrochnemon glaucum, Anabasis articulata, Suaeda pruinosa, Aristida scoparia, Limoniastrum monopetalum, Zygophyllum album and Pennisetum dichotomum. The root systems--both primary and adventitious--were uncovered and drawn, the floristic associations at the site described, soil properties analyzed and areal water conditions noted. It was concluded that soil accumulation stimulated adventitious root formation which may often be greater in surface area than the primary roots. These roots function in accumulating organic matter and binding soil water, probably being responsible for a considerable part of total plant water uptake. The plants are classified according to adventitious root structure: I. Monocotyledenous species--long, thread-like roots; II. Dicotyledenous species, Type A-Laterals similar to primaries; Type B-Hairy, fine, short and only in mound body; Type C-Both long, thread-like and tufted, fine. (Casey-Arizona)
W71-04295

PERENNATION IN ASTRAGALUS LENTIGINOSUS AND TRIDENS PULCHELLUS IN RELATION TO RAINFALL,
California Univ., Los Angles. Lab. of nuclear Medicine and Radiation Biology.
Janice C. Beatley.
AEC Contract No. AT (04-1) Gen-12. Madrono, Vol 20, No 6, p 326-332, April 1970. 2 tab, 2 ref.

Descriptors: *Arid lands, *Rainfall, *Soil moisture, *Plant populations, Ecology, Environmental effects, Nevada, Grasses, Legumes, On-site data collections, Rain gages, Plant growth, Biological communities, Elevation, Seasonal, Germination, Xerophytes, Deserts, Annual.
Identifiers: *Perennation, *Transects, *Adaptability, *Seedlings, Mojave Desert.

In late winter-early spring of 1965, unusually heavy rains fell at the Nevada test site in south-central Nevada. These were followed by conspicuously large numbers of A. lentiginosus (Leguminosae) and T. pulchellus (Gramineae). In late autumn, 1965, the rains were even heavier and were followed in the spring of 1966 by spectacular flowering populations of A. lentiginosus. On permanent study sites in the area, year-round data collections were kept on environmental variables and plant populations. Most of the Astragalus seedlings lived to flower the following spring, then died. These were distinctly biennials. Perennial populations occurred mostly at higher elevations associated with more frequent and greater rainfall. Seeds of T. pylchellus may germinate in either spring or fall and, for the most part, the plants exhibit a winter annual growth regime. It appears that germination is dependent on soil moisture and perennation is dependent on rainfall regularity. In plants such as Astragalus the ability to occur as annuals, biennials or perennials, may confer a high level of adaptability to a wide range of environmental conditions. (Casey-Arizona)
W71-04299

ROOT DEVELOPMENT OF TWO COMMON SPECIES IN DIFFERENT HABITATS IN THE MEDITERRANEAN SUBREGION IN EGYPT,
Cairo Univ., Giza (Egypt). Dept. of Botany.
K. H. Batanouny, and M. A. F. Zaki.
Acta Botanica Acadamiae Scientiarum Hungaricae, Vol 15, No 3-4, p 217-226, 1969. 3 fig, 12 ref.

Descriptors: *Soil physical properties, *Root development, *Arid lands, *Plant growth, *Soil-water-plant relationships, On-site investigations, Xerophytes, Environmental effects, Soil chemical properties, Soil structure, Soil texture, Soil moisture, Percolation, Plant populations, Plant morphology, Vegetation establishment, Root systems, Root zone, Ecology, Cultivated lands, Distribution patterns.
Identifiers: *Egypt, Plant associations.

Plant species of widespread distribution show great differences in growth and vitality in differeing areas. Studies of the causes of these differences, particularly in terms of root systems, may yield information on soil and water relations, allowing an adequate assessment of areal crop potential. Root systems and soil properties of 2 common Mediterranean coastal species, Thymelaea hirsuta and Pithyranthus tortuosus, were studied in 5 different plant associations. Soil penetrability was measured with a stratometer. The root systems of both species were shallowest in an association on a degraded, stony, hardly penetrable soil with a low moisture content, and this was accompanied by a relatively small plant size. In an area where this soil was cultivated for barley, the root systems of T. hirsuta were much deeper and the plant much larger. Since it is felt that species genetic potential for growth does not differ between areas, the effect of cultivation must have been a change in soil structure such that resistances to root penetration, percolation and aeration were much lower. This was supported by much lower soil penetrability measurements in the cultivated areas. (Casey-Arizona)
W71-04300

RESPONSES OF NATIVE AND MIGRANT DESERT RESIDENTS TO ARID HEAT,
Hawaii Univ., Honolulu. Pacific Biomedical Research Center.
Joel M. Hanna.
American Journal of Physical Anthropology, Vol 32, No 2, p 187-195, March 1970. 3 fig, 5 tab, 14 ref.

Descriptors: *Acclimatization, *Human population, *Arid climates, *Water loss, *Thermal stress, *Physiological ecology, Animal physiology, Temperature, Water balance, Moisture stress, Respiration, Environmental effects, Circulation (Animals), Metabolism, Heat balance, Mode of action, Humidity, Heat resistance, Arizona, Mexico, Deserts, Variability, Data collections, Stress.
Identifiers: *Sweating, *Sonoran Desert, *Anthropology, *Adaptability.

The problem of racial differences in heat tolerance has not been fully investigated in hot, arid climates. Previous evidence infers that acclimatization is a factor at least as important as genetic differences. Groups of Yacqui Indians and Mestizos from Hermosillo, Sonora, Mexico, and Caucasian University students and Papago Indians from Tucson, Arizona, were subjected to exercises in arid summer heat and their physiological responses were measured. The Mestizos and Yaquis showed no significant differences in heart rate, rectal temperatures or sweat rate. However, when White students were compared to Papago Indians, the latter had significantly lower rectal temperatures and sweat rates, which could be accounted for in part by their smaller size. None of the groups demonstrated characteristic changes of acclimatization. In hot, humid environmentally controlled rooms, the Yacquis and Mestizos fell into an intermediate position between acclimatized and unacclimatized Caucasions. It is concluded that desert acclimatization does not confer maximal acclimatization to humid heat. The lower rectal temperatures of the Papagos may represent a more effective, hereditary heat dissipation mechanism. (Casey-Arizona)
W71-04301

EVALUATION OF IRRIGATION WATER AND NITROGEN FERTILIZER IN CORN PRODUCTION,
Colorado State Univ., Fort Collins. Dept. of Economics; and Colorado State Univ., Fort Collins. Dept. of Agronomy.
For primary bibliographic entry see Field 03F.
W71-04304

2J. Erosion and Sedimentation

GREAT LAKES SHORELAND MANAGEMENT AND EROSION DAMAGE CONTROL FOR MICHIGAN.
Michigan Water Resources Commission, Lansing. Dept. of Natural Resources.
For primary bibliographic entry see Field 02H.
W71-03908

THE PERIODIC CYCLE OF PARTICULATE MATTER IN A SHALLOW, TEMPERATE ESTUARY,
New Hampshire Univ., Durham. Jackson Estuarine Lab.
For primary bibliographic entry see Field 02L.
W71-03943

MINERAL AND CHEMICAL COMPOSITION OF SEDIMENTS FROM THE STRAITS OF FLORIDA,
Atlantic Oceanographic and Meteorological Labs., Miami, Fla.
John D. Gassaway.
Journal of Sedimentary Petrology, Vol 40, No 4, p 1136-1146, December 1970. 11 p, 8 fig, 3 tab, 38 ref.

Descriptors: *Mineralogy, *Bottom sediments, *Currents (Water), *Sediment transport, *Provenance, Florida, Sampling, Dispersion, X-ray analysis, X-ray diffraction, Trace elements, Tracking techniques, Cores, Statistical methods, Distribution patterns.
Identifiers: *Florida Straits, Gulf Stream.

In the Straits of Florida the Florida Current contributes a low-magnesian calcitic biogenic ooze, the Bahama Banks supply highly aragonitic sediments, and 'relict' sediments are the source for the detrital silicates and phosphates. The Miami Terrace Reef has a relatively large amount of high-magnesian calcite. Offshore currents carry the detrital material southward until they are blocked by the Florida Current. Aragonitic sediments move westerly from the Bahama Banks. The mineral suite of the Straits of Florida sediments is composed principally of biogenic carbonates except to the northwest. Strontium and chromium are positively correlated with aragonite. Strontium is not significantly enriched in the carbonate sediments after deposition. Manganese and cobalt vary directly with each other, and statistical analysis shows that they are present in the same phase. The Florida Current is a principal source for the distribution of manganese and cobalt in the Straits of Florida. Iron, zinc and chromium are correlated with the 'relict' sediments to the northwest where their most probable source is the carbonate-fluorapatite. (Knapp-USGS)
W71-03944

A GEOCHEMICAL TREND IN SILICON-ALUMINUM-IRON RATIOS AND THE CLASSIFICATION OF CLASTIC SEDIMENTS,
Kentucky Univ., Lexington.
For primary bibliographic entry see Field 02K.
W71-03945

COMPARISON OF THE DESCRIPTORS OF SEDIMENT GRAIN-SIZE DISTRIBUTIONS,
Northwestern Univ., Evanston, Ill.
Thomas A. Jones.
Journal of Sedimentary Petrology, Vol 40, No 4, p 1204-1215, December 1970. 12 p, 6 fig, 6 tab, 24 ref, append.

Descriptors: *Particle size, *Statistical methods, Frequency analysis, Charts, Surveys, Grading, Histograms, Sediments.
Identifiers: *Particle size distributions.

Weight-frequency data are routinely analyzed either by moment computations or by graphical (percentile) techniques. However, both methods have serious drawbacks. The moment measures are biased, and may have errors induced by grouping or by truncation of part of the sample (pan fraction). The graphical measures may have errors because of interpolation of percentiles. More seriously the graphical statistics are highly interrelated, so varying amounts of skewness and kurtosis will affect the estimates of all parameters. Because both the moment and graphical methods have defects, an alternative estimation technique is desirable. Fitting a cumulative Edgeworth distribution to the observed cumulative data provides estimates which do not have these undesirable properties. A brief replication study shows that the variance of the Edgeworth estimates is generally less than those of the graphical and sample moment estimates. (Knapp-USGS)
W71-03947

DEPOSITIONAL AND DISPERSAL DYNAMICS OF INTERTIDAL SAND BARS,
Illinois Univ., Urbana. Dept. of Geology.
George DeVries Klein.
Journal of Sedimentary Petrology, Vol 40, No 4, p 1095-1127, December 1970. 33 p, 34 fig, 8 tab, 71 ref.

Descriptors: *Sand bars, *Tidal effects, *Intertidal areas, *Sediment transport, *Sedimentary structures, Currents (Water), Coasts, Shoals, Dispersion, Sedimentary basins (Geological), Tracers, Dye releases, Water circulation, Beaches, Tides, Waves (Water), Mud flats, Sedimentation.
Identifiers: *Minas Basin (Nova Scotia).

The intertidal sand bars of the Minas Basin, Nova Scotia, are asymmetrical in cross-section and linear in plan. They are formed and reworked by tidal currents which are characterized by an asymmetric time-velocity profile. Average bottom ebb current velocities (90 cm/sec) exceed average bottom flood current velocities (65 cm/sec) over gently-sloping (2 to 3 degree) bar surfaces, whereas over steep-sloping (8 degree) bar surfaces, average bottom flood current velocities (90 cm/sec) were found to exceed average bottom ebb current velocities (65 cm/sec). On steeper bar slopes, the sediment is fine-grained sand and is characterized by airholes, planar lamination, and surface dunes and ripples. On the gentler bar slopes, the texture of the sediment is medium-grained and coarse-grained sand which has been fashioned into current ripples, simple dunes, complex dunes, simple sand waves and complex sand waves. Individual tracer grains are dispersed in a radial-elliptical pattern from a point source. The sand bars are aligned parallel to basinal topographic trend and in turn segregate zones of flood- and ebb-dominated bottom current systems. Comparison of low-tide airphotos taken in 1938, 1947, and 1963 in one of the study areas shows a slight erosional regime. (Knapp-USGS)
W71-03948

A MECHANICAL DEVICE FOR RELEASING FLUORESCENT TRACERS,
Geological Survey of India, Calcutta. Marine Geology Unit.
For primary bibliographic entry see Field 07B.
W71-03949

MICROBIAL CARBONATE AND PHOSPHATE PRECIPITATES FROM SEA WATER CULTURES,
Smithsonian Institution, Washington, D.C.
For primary bibliographic entry see Field 02K.
W71-03950

EMPIRICAL RELATIONSHIPS BETWEEN MASS PHYSICAL PROPERTIES FOR RECENT MARINE SEDIMENTS OFF SOUTHERN CALIFORNIA,
Lockheed Missiles and Space Co., San Diego, Calif. Ocean Lab.
A. L. Inderbitzen.
Marine Geology, Vol 9, No 5, p 311-329, December 1970. 19 p, 7 fig, 5 tab, 29 ref.

Descriptors: *Bottom sediments, *Physical properties, *Moisture content, *Clay minerals, *Particle size, Sedimentation, Mechanical properties, Sedimentation rates, Deposition (Sediments).
Identifiers: *Sediment physical properties.

Mass physical property data, obtained by testing 137 cores of recent marine sediments in and around the continental borderland, were analyzed to determine the relationship between shear strength and sedimentation rate. General increases were found in clay and water content with distance offshore. Values for void ratio of the sediment increase with increasing clay-size fraction and decrease with increasing shear strength. The slope of the void ratio-percent clay relationship appears related to sedimentation rate: the steeper the slope, the faster the rate of deposition. Both the increase of shear strength and decrease of water content with depth in the sediment appear to be linear functions. There appear to be no direct correlations between sedimentation rate and: (1) amount of clay-size material in the sediment; (2) rate of shear strength increase with depth; or (3) rate of water content decrease with depth in the sediment. As sedimentation rate increases, so does the range of water content a sediment may contain for a given percentage of clay. The exact limits of that range are dependent on the clay mineralogy. As the amount of water within the sediment increases, the shear strength decreases. Therefore, the more rapidly a given material is deposited the more water it can contain and the lower its shear strength. (Knapp-USGS)
W71-03951

VARIATION IN THE LEVEL OF THE CLIFF/SHORE PLATFORM JUNCTION ALONG THE SOUTH COAST OF GREAT BRITAIN,
Queen Mary Coll., London (England).
L. W. Wright.
Marine Geology, Vol 9, No 5, p 347-353, December 1970. 7 p, 3 fig, 16 ref.

Descriptors: *Shores, *Seashores, *Beach erosion, Beaches, High water mark, Low water mark, Topography, Geomorphology, Marine geology, Terraces (Geological).
Identifiers: *Great Britain.

Precise leveling of the junction between the cliff and the shore platform has indicated that there is a variation of more than 4 m in its height along the southern coast of Great Britain. At most localities the junction is to be found between the Mean High Water Spring and Mean High Water Neap levels. Local variation may amount to 4 m as a result of the interaction of geological, marine and topographic variables. Comparable differences occur between the cliff-line and the stranded shore platforms that characterize the coast of south Devon and Cornwall. (Knapp-USGS)
W71-03952

TIDAL SAND MOVEMENT BETWEEN SOME LINEAR SAND BANKS IN THE NORTH SEA OFF NORTHEAST NORFOLK,
British Petroleum Co., Ltd; Sunbury-on-Thames (England); and National Inst. of Oceanography, Wormley (England).
V. N. D. Caston, and A. H. Stride.
Marine Geology, Vol 9, No 5, p M38-M42, December 1970. 5 p, 2 fig, 10 ref.

Descriptors: *Sediment transport, *Bottom sediments, *Sands, *Ocean currents, Sediments, Bed load, Sedimentary structures, Currents (Water), Sand bars, Shoals.
Identifiers: *North Sea.

In the long sand banks of the southern North Sea off Norfolk, new sand wave and current data indicate a northerly flow of sand on the western sides of the banks and southerly flow on their eastern slopes. The net direction is indicated by the steep northeastern slopes of the banks. Northerly flow is found north and south of them. (Knapp-USGS)
W71-03953

THE DIFFUSION OF IONS IN UNCONSOLIDATED SEDIMENTS,
Woods Hole Oceanographic Institution, Mass.
For primary bibliographic entry see Field 02K.
W71-03954

RADIOMETRIC INVESTIGATIONS ON THE BEACH AT THE MOUTH OF THE KURA RIVER,
B. S. Shteyman, A. N. Shatsov, A. N. Tsitsarev, A. A. Yemel'yanov, and V. T. Myshkin.
Translated from Trudy ZakNIGMI, No 32 (38), p 68-78, 1969. Soviet Hydrology: Selected Papers, Issue No 5, p 511-518, 1969. 8 p, 5 fig, 2 tab, 14 ref.

Descriptors: *Deltas, *Sedimentation, *Tracers, *Tracking techniques, Radioactivity techniques, Littoral drift, Sediment yield, Sediment load, Bed load, Suspended load, Provenance, Coasts, Shores, Beach erosion.
Identifiers: *Kura River (USSR).

The movement of sediments on the beach at the mouth of the Kura River, USSR, was studied by various methods, the most promising of which uses the natural radioactivity of the sediments. Natural radioactivity is easily sensed by instruments even at low concentrations, and it is independent of external factors. Sediments contain a large amount of radioisotopes of radium, strontium, rubidium, potassium, and other elements. Radiometric methods were used in the investigation of sedimentation at the mouth of the Kura River because standard methods are laborious, point sampling does not exclude an element of randomness, and, most important, sediment sampling over a large water area is time consuming and requires good weather. The radiometric method permits rapid and continuous investigation of deposition of river sediments in the beach area. The longshore flow of Kura River sediments is from the north and toward the beach area of the main southeastern arm. Solid discharge through the northeastern arm is negligible (0.6 million tons/year). The decrease in the flow of sediments through this arm from 50% (1938) to 5% (1965) of the total discharge of the Kura River has produced severe abrasion of the delta shore. Hydraulic conditions in the channel are responsible for the dying out of the northeastern arm. (Knapp-USGS)
W71-03962

SOME ASPECTS OF THE FORMATION OF MUDFLOWS AND METHODS OF COMPUTING THEM,
Yu. B. Vinogradov.
Translated from Trudy KazNIGMI, No 33, p 5-29, 1969. Soviet Hydrology: Selected Papers, No 5, p 480-500, 1969. 21 p, 8 fig, 1 tab, 16 ref, 3 append.

Descriptors: *Mudflows, *Floods, Classification, Erosion, Sediment transport, Mass wasting, Sedimentation, Sedimentology, Geomorphology, Sediment yield, Open channel flow.
Identifiers: *Mudflow classification.

A classification scheme of mudflow phenomena is presented. The classification is based on the following principle: the input is the character of hydrometeorological processes that lead to given flood conditions; the qualitative transformation operator is the type of mudflow source, which reacts in a definite manner to the hydrometeorological situation; and at the output is the type of mudflow process. Hydrometeorological conditions of mudflow formation include heavy showers of sufficient duration, extremely fast rate of snow melting under exceptional conditions (such as volcanic eruptions, for example), and waves of water released during breaches of temporarily impounded lakes or artificial mountain reservoirs. The types of catchments include catchments with active surface runoff, erosional mudflow sources composed of loose and relatively easily destroyed and eroded material with occasional inclusions of rock fragments, erosional mudflow sources consisting of blocky rock debris with a highly erosible filler, and rocky mudflow sources. Types of mudflow phenomena are mud floods, gravity flows of soil suspension, and gravity rock flows. (Knapp-USGS)
W71-03963

HYDRAULIC CRITERIA OF STREAMS WITH A MOBILE BOTTOM,
N. S. Znamenskaya.
Translated from Trudy Gos Gidrol Inst-ta, No 173, p 43-48, 1969. Soviet Hydrology: Selected Papers, No 5, p 452-455, 1969. 4 p, 1 fig, 5 ref.

Descriptors: *Scour, *Sediment transport, *Bed load, Alluvial channels, Open channel flow, Hydraulics, Channel morphology, Froude number, Reynolds number, Viscosity, Tractive forces, Roughness (Hydraulic).
Identifiers: *Mobile-bed streams.

The main forces determining turbulent flow are gravity, inertia, and viscosity. The most common criteria used in the hydraulics of open channels are dimensionless relationships including Froude number, which allows for the forces of intertia and gravity, and Reynolds number, which takes into account the forces of inertia and viscosity. Hydraulic criteria must be used with criteria reflecting the mobility of the sediments. Mobility depends on size and specific weight. Dimensionless ratios used as criteria of bed load mobility include the ratio of average velocity to nonscouring velocity, and the ratio of the drag force to the critical drag force. The fact that the start of particle movement is related to observable velocity and drag data is in favor of these or similar criteria. The best criterion in use at present is the ratio of average velocity to fall velocity because: (1) the fall velocity may be determined much more accurately than the nonscouring velocity; (2) the variation in fall velocity with temperature is known; and (3) results have been obtained from study of the variation of fall velocity with the concentration of suspended particles. (Knapp-USGS)
W71-03965

ROD-MOUNTED BOTTOM GRAB,
For primary bibliographic entry see Field 07B.
W71-03967

PATTERN OF VARIATION OF THE LENGTH OF FREELY MEANDERING RIVERS,
E. A. Konditerova, and I. V. Ivanov.
Translated from Trudy Gos Gidrol Inst-ta, No 169, p 3-17, 1969. Soviet Hydrology: Selected Papers, No 4, p 356-364, 1969. 9 p, 5 fig, 1 tab.

Descriptors: *Meanders, *Alluvial channels, Geomorphology, Channel morphology, Rivers, Stream erosion, Scour, Sediment transport, Sedimentation.
Identifiers: *Irtysh River, *USSR, Stream length.

In studying the morphometric patterns of various types of channel processes the Department of Channel Processes of the State Hydrologic Institute, USSR, examined the patterns of free mean-

dering. This type of channel process occurs over about half (42%) of the length of the Irtysh River reaches studied. The purpose of this study was to determine the main patterns of change in river length under free meandering conditions. On the whole, the entire reach of the Irtysh River under study has shortened by only 650 m between 1904 and 1958. This reach (380 km long), confined to a morphologically uniform, free meandering stretch without tributaries, is an example of a closed cycle of length changes of a type of channel process where free meandering clearly predominates. With predominantly free meandering, the increase in the length of meanders during their horizontal deformations was compensated by breaches in channel loops. The rapid elongation of individual meanders may stabilize the development of neighboring meanders by reducing the rates of their horizontal deformations. (Knapp-USGS)
W71-03969

MUD FLOWS AND FLOODS AND THEIR CONTROL,
M. S. Gagoshidze.
Trans from Gidrotekhnika i melioratsiya, No 11, p 29-43, 1969. Soviet Hydrology: Selected Papers, No 4, p 410-422, 1969. 13 p, 10 fig, 2 tab, 11 ref.

Descriptors: *Mudflows, *Flood control, Dams, Floods, Check structures, Regulation, Sediment transport, Flood protection, Flash floods, Diversion, Flow control.
Identifiers: *Mudflow control, USSR.

Mudflows are dense, cohesive, and structured. The water in the mud mass is bound and does not perform a transporting function. Mud floods are fluid, turbulent, and noncohesive. The water in them is enriched with a colloidal suspension and is the transporting medium. Mudflows are the most destructive type of mountain runoff. They form in nearly all the mountain regions of the Soviet Union. Protection from mudflows and improvement of a mudflow basin is achieved by a combination of organizational-agricultural, phytoreclamation, and hydraulic engineering measures. Hydraulic installations are used to control mudflows that have already formed. (1) Mudflow regulating structures are designed to conduct, direct, discharge, and break the mudflows. (2) The mudflow separating structures (contracted weirs, openwork dams, cable mud cutters, and sediment barriers) are designed to arrest the coarse and pass the small fraction of the mudflow. (3) Solid structures (dams, excavations, dikes) are built to arrest mudflows and other types of mountain flow. Arresting structures with openings (openwork dams) are built to arrest the mudflow mass and pass the flood runoff. (4) Mudflow transforming sturctures are designed to transform structural mudflows into floods. (Knapp-USGS)
W71-03970

SEDIMENT TRANSPORT IN DEGRADING RIVERS,
California Univ., Berkeley. Dept. of Civil Engineering.
Hans A. Einstein.
California University Water Resources Center Technical Completion Report, January 22, 1969. 6 p. OWRR Project A-023-CAL (1).

Descriptors: *Sediment transport, *Degradation (Stream), *Reviews, *Stream erosion, *Dams, Streams, Flow control, Equilibrium, Streamflow, Investigations, Model studies, Flumes, Channel morphology, Streambeds, Stress, Flow resistance, Boundaries (Surfaces), Flow rates, Sediments, Cross-sections, Bed load, Statistical analysis, Friction, Scour, Particle size.
Identifiers: Dam effects on downstream channels.

When a dam is constructed across a river the equilibrium of sediment movement is greatly disturbed causing the river downstream to start degrading, a process that continues until a new equilibrium is reached. This report summarizes studies made on the subject since 1963. Some of the results are as follows: (1) The friction factor for a flow over a sediment bed is usually divided into two parts, the grain resistance and the shape resistance. Both are present in a degrading bed of uniform material the same as in an equilibrium flow. In mixed beds, segregation must be taken into account. (2) A flume study conducted in a circular flume of rectangular cross section showed that the shape of the sediment bed may be predicted from the velocity distribution. (3) A generalized shape of river cross-sections can be predicted as a function of the river curvature of the channel preceding the section. (4) Check experiments verified that during scour the roughness of a mud bottom is somewhat higher than at equilibrium. At equilibrium the mud, consisting of silt and clay in salt water, is hydraulically smooth. (5) Scattered blocks on a slowly scouring sediment bed of small sediment transport will by their additional resistance first reduce the shape resistance of the bed, and only after that will they reduce the sediment transport and scour. (Woodard-USGS)
W71-03995

BEDLOAD FORMULAS. PART A. A SELECTION OF BEDLOAD FORMULAS. PART B. PROGRAM LISTINGS FOR BEDLOAD FORMULAS,
Pennsylvania State Univ., University Park. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02E.
W71-03999

QUALITY OF SURFACE WATERS OF THE UNITED STATES, 1965: PARTS 7 AND 8. LOWER MISSISSIPPI RIVER BASIN AND WESTERN GULF OF MEXICO BASINS.
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02K.
W71-04048

SOME ASPECTS OF THE GEOMORPHOLOGY OF THE AIR MOUNTAINS, SOUTHERN SAHARA,
Ahmadu Bello Univ., Zaria (Nigeria). Dept. of Geography.
For primary bibliographic entry see Field 02G.
W71-04050

SOME PROBLEMS OF A KARST AREA IN THE EASTERN TRANSVAAL, SOUTH AFRICA,
University of the Witwatersrand, Johannesburg (South Africa). Dept. of Geography.
For primary bibliographic entry see Field 02G.
W71-04053

ON THE ACCURACY OF BED-MATERIAL SAMPLING,
Waterloopkundig Laboratorium, Delft (Netherlands).
M. de Vries.
Text also in French. Journal of Hydraulic Research, Vol 8, No 4, p 523-533, 1970. 11 p, 2 fig, 1 tab, 2 ref.

Descriptors: *Sampling, *Bottom sediments, *Statistical methods, *Statistics, *Sieve analysis, Analytical techniques, Sands, Gravels, Particle size, Sieves, Measurement, Data collections, Probability, Variability.
Identifiers: *Bed sediment sampling.

The minimum amount of sediment to be sampled for a valid statistical analysis was determined analytically and compared with results of field studies. The results of the analysis are especially valuable if relatively coarse sediments are studied. For fine sand the samples are usually large enough to assume the presence of small errors. Coarse sand and gravel require samples too large to be sieved directly. Sample splitting and sieving of all parts is required. The composition of the bed material may change with time and place. If there exists a large degree of inhomogeneity, the selection of the locations of sampling becomes important. In this case the required accuracy for each sample may be rather low, unless the degree of inhomogeneity is the topic to be studied (grain-sorting). (Knapp-USGS)
W71-04132

AN OVERVIEW OF U.S. DEPARTMENT OF INTERIOR'S ROLE IN SEDIMENT CONTROL,
Federal Water Quality Administration, Washington, D.C. Div. of Applied Science and Technology; and Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 04D.
W71-04147

TECHNOLOGY FOR SEDIMENT CONTROL IN URBAN AREAS,
Agricultural Research Service, Washington, D.C. Sedimentation Lab.
For primary bibliographic entry see Field 04D.
W71-04148

THE CONTROL OF EROSION AND SEDIMENT IN HIGHWAY CONSTRUCTION,
Bureau of Public Roads, Washington, D.C.
For primary bibliographic entry see Field 04D.
W71-04149

THE EFFECT OF VEGETATION CONVERSION AND FLOOD DISCHARGE ON STREAM CHANNEL GEOMETRY: THE CASE OF SOUTHERN CALIFORNIA WATERSHEDS,
California Univ., Los Angeles.
For primary bibliographic entry see Field 04D.
W71-04230

INFILTRATION AND SOIL EROSION AS INFLUENCED BY VEGETATION AND SOIL IN NORTHERN UTAH,
Forest Service (USDA), Reno, Nev. Intermountain Forest and Range Experiment Station.
R. O. Meeuwig.
Journal of Range Management, Vol 23, No 3, p 185-188, May 1970. 4 p, 8 fig.

Descriptors: *Infiltration, *Erosion, *Vegetation effects, *Soil properties, Soil aggregates, Soil density, Organic matter, Soil surfaces, Utah, Soil moisture, Simulated rainfall.
Identifiers: *Slope gradient.

The influences of vegetation, soil properties, and slope gradient on infiltration capacity and soil stability of high-elevation herbland on the Wasatch Front in northern Utah were investigated under simulated rainfall conditions. Results emphasize the importance of vegetation and litter cover in maintaining infiltration capacity and soil stability. Infiltration is also affected significantly by soil properties, notably bulk density, aggregation and moisture content. (Meeuwig-Forest Service)
W71-04260

INFILTRATION AND SOIL EROSION ON COOLWATER RIDGE, IDAHO,
Forest Service (USDA), Reno, Nev. Intermountain Forest and Range Experiment Station.
R. O. Meeuwig.
USDA Forest Service Research Note INT-103, 1969. 5 p, 2 fig.

Descriptors: *Infiltration, *Erosion, *Vegetation effects, Soil texture, Organic matter, Wettability, Idaho, Simulated rainfall.
Identifiers: *Non-wettable soils.

The infiltration and erosion caused by simulated rainfall were measured on a granitic subalpine ridge in north-central Idaho. Erosion was closely correlated with the amount of exposed soil. Infiltration was not highly correlated with any single factor. However, three soil properties (organic-matter

content, clay content, and moisture-holding capacity at 20-centimeter tension) in combination were found to be good predictors of infiltration. (Meeuwig-Forest Service)
W71-04261

2K. Chemical Processes

EFFECT OF DISPERSION, GRAVITATIONAL SEGREGATION, AND FORMATION STRATIFICATION ON THE RECOVERY OF FRESHWATER STORED IN SALINE AQUIFERS,
Louisiana State Univ., Baton Rouge.
For primary bibliographic entry see Field 02F.
W71-03870

THE INCIDENCE AND FORMATION OF MINE DRAINAGE POLLUTION - APPENDIX C TO 'REPORT FOR DEVELOPMENT OF WATER RESOURCES OF APPALACHIA'.
Corps of Engineers, Cincinnati, Ohio. Office of Appalachian Studies.
For primary bibliographic entry see Field 05B.
W71-03872

STREAM POLLUTION BY COAL MINE DRAINAGE IN APPALACHIA.
Federal Water Quality Administration, Cincinnati, Ohio.
For primary bibliographic entry see Field 05B.
W71-03873

A REVIEW OF CURRENT RESEARCH ON COAL MINE DRAINAGE IN APPALACHIA,
Bureau of Mines, Pittsburgh, Pa. Area 1 Mineral Resources Office.
For primary bibliographic entry see Field 05B.
W71-03874

FACTORS THAT AFFECT THE FORMATION OF COAL MINE DRAINAGE POLLUTION IN APPALACHIA,
Bureau of Mines, Pittsburgh, Pa. Area 1 Mineral Resource Office.
For primary bibliographic entry see Field 05B.
W71-03875

THE OXIDATION OF PYRITE ASSOCIATED WITH COAL MINES,
Bureau of Mines, Pittsburgh, Pa. Area 1 Mineral Resource Office.
For primary bibliographic entry see Field 05B.
W71-03876

DENTISTRY PROFESSOR EXPLAINS POLYWATER.
For primary bibliographic entry see Field 01B.
W71-03926

SPECTROPHOTOMETRIC DETERMINATION OF THIOCYANATE AND OXALATE,
Missouri Univ., Columbia. Dept. of Chemistry.
For primary bibliographic entry see Field 05A.
W71-03928

QUALITY OF RUNOFF FROM DIVERSIFIED URBAN WATERSHEDS,
Arizona Univ., Tucson. Dept. of Civil Engineering and Engineering Mechanics.
For primary bibliographic entry see Field 05A.
W71-03929

WATER-QUALITY DATA FOR THE FLAMING GORGE RESERVOIR AREA, UTAH AND WYOMING,
Geological Survey, Salt Lake City, Utah.
For primary bibliographic entry see Field 07C.
W71-03936

ADSORPTION OF BORON BY FERROMAGNESIAN MINERALS AND MAGNESIUM HYDROXIDE,
Agricultural Research Service, Riverside, Calif. Soil and Water Conservation Research Div.
For primary bibliographic entry see Field 02G.
W71-03939

PEDOGENIC DISTRIBUTION OF ZINC IN MOLLISOLS AND ASSOCIATED ENTISOLS IN NEBRASKA,
Nebraska Univ., Lincoln. Dept. of Agronomy.
For primary bibliographic entry see Field 02G.
W71-03940

SOLUBILITY AND AVAILABILITY OF SORBED SULFATE IN HAWAIIAN SOILS,
Hawaii Univ., Honolulu. Dept. of Agronomy and Soil Science.
For primary bibliographic entry see Field 02G.
W71-03941

THE DIFFUSION OF COPPER, MANGANESE, AND ZINC AS AFFECTED BY CONCENTRATION, CLAY MINERALOGY, AND ASSOCIATED ANIONS,
Kentucky Univ., Lexington. Dept. of Agronomy.
For primary bibliographic entry see Field 02G.
W71-03942

A GEOCHEMICAL TREND IN SILICON-ALUMINUM-IRON RATIOS AND THE CLASSIFICATION OF CLASTIC SEDIMENTS,
Kentucky Univ., Lexington.
Bruce R. Moore, and William H. Dennen.
Journal of Sedimentary Petrology, Vol 40, No 4, p 1147-1152, December 1970. 6 p, 2 fig, 1 tab, 38 ref.

Descriptors: *Sediments, *Weathering, *Diagenesis, *Metamorphic rocks, *Provenance, Geochemistry, Igneous rocks, Classification, Aluminum, Iron, Sediment transport.
Identifiers: *Sorting (Sediments), Silicon.

Plots of the principal elements Si, Al, Fe for normal clastic sediments reveal a very definite geochemical trend for these elements. Al/Fe ratios lie between 1.5 and 2.5 while Si is continuously variable but has clearly distinguishable ranges for each of the currently used sediment types when plotted on a Si-Al-Fe ternary diagram. Igneous rocks undergoing weathering tend to move in composition toward the Si, Al, Fe 'main sequence' and later separate by hydraulic sorting toward either the coarser quartzose sandstone or finer shale ends of this sequence. The results indicate the possibility of clarification of existing classifications and of determining the parent-rock types of certain metasediments. (Knapp-USGS)
W71-03945

MICROBIAL CARBONATE AND PHOSPHATE PRECIPITATES FROM SEA WATER CULTURES,
Smithsonian Institution, Washington, D.C.
P. G. Malone, and K. M. Towe.
Marine Geology, Vol 9, No 5, p 301-309, December 1970. 9 p, 3 fig, 27 ref.

Descriptors: *Water chemistry, *Carbonates, *Phosphates, *Sea water, *Biodegradation, Nitrates, Organic matter, Chemical precipitation, Nutrients, Calcium carbonate, Calcite, Diagenesis, Connate water.
Identifiers: Struvite.

Nitrogenous organic materials were allowed to decompose in seawater at approximately 24 deg C under varying conditions of aeration. In aerated cultures the mineral struvite ($NH_4MgPO_4 \cdot 6H_2O$) is formed by a reaction between phosphate and ammonia from the decomposing organic material and magnesium in the seawater. Cultures grown in paper-plugged flasks produced precipitates consisting of struvite and monohydrocalcite. Cultures grown in tightly-stoppered flasks produced a precipitate consisting of calcite containing approximately 14 mol% $MgCO_3$ and struvite. The uncomplicated nature of these results suggests that similar phases may be produced in varying natural situations where nitrogenous organic material decays in seawater or in contact with interstitial water in sediments. (Knapp-USGS)
W71-03950

THE DIFFUSION OF IONS IN UNCONSOLIDATED SEDIMENTS,
Woods Hole Oceanographic Institution, Mass.
F. T. Manheim.
Earth and Planetary Science Letters, Vol 9, No 4, p 307-309, November 1970. 3 p, 1 fig, 1 tab, 20 ref.

Descriptors: *Diffusion, *Ion transport, *Sediments, *Porosity, Diffusivity, Aqueous solutions, Electrolytes, Translocation, Ion exchange, Diagenesis, Viscosity, Water temperature, Clays, Clay minerals, Connate water.
Identifiers: *Ion diffusion.

Diffusion in unconsolidated sediments generally proceeds at rates ranging from half to one twentieth of those applying to diffusion of ions and molecules in free solution. Diffusion rates are predictable with respect to porosity and path tortuosity in host sediments, and can be conveniently measured by determinations of electrical resistivity on bulk sediment samples. Net ion flux is further influenced by reactions of diffusing species with enclosing sediments, but such influences should not be confused with or lumped with diffusion processes. (Knapp-USGS)
W71-03954

SUBMARINE VOLCANISM AS A SOURCE FOR IRON,
Rosenstiel School of Marine and Atmospheric Sciences, Miami, Fla.
Kurt Bostrom.
Earth and Planetary Science Letters, Vol 9, No 4, p 348-354, November 1, 1970. 7 p, 6 fig, 12 ref.

Descriptors: *Water chemistry, *Iron, *Sea water, *Distribution patterns, *Geochemistry, Solubility, Chemical precipitation, Volcanoes, Aqueous solutions, Sediments, Deposition (Sediments).
Identifiers: Iron distribution (Pacific).

Deposition rates of iron on the East Pacific Rise are 4-30 times larger than in surrounding areas of the Pacific, suggesting local volcanism to be the source of iron. The distribution of Co, Ni, Mn, Ti and Al support this conclusion. Other geochemical relations in the East Pacific also suggest that the iron sediments on the Ridge are of local origin. Stability relations for oxides-hydroxides of Fe, Mn, Ni and Co suggest that in the well-oxygenated slightly alkaline bottom waters of the ocean, iron should precipitate out fairly fast, followed by manganese, whereas Ni and Co should be most mobile and tend to be enriched in the moist land-distant areas. Because continental matter has been recycled repeatedly during the history of the Earth while the volcanic iron described may represent a new contribution to the surface of the Earth, and because ocean floor spreading may have been operating during most of the history of the Earth, it follows that a large fraction of the total amount of iron now at the Earth's surface may have been brought up by submarine volcanism. (Knapp-USGS)
W71-03955

CHEMICAL EXCHANGE BETWEEN SEA WATER AND DEEP OCEAN BASALTS,
Naval Oceanographic Office, Washington, D.C. Project GOFAR.
Roger Hart.
Earth and Planetary Science Letters, Vol 9, No 3, p 269-279, October 1970. 11 p, 4 fig, 2 tab, 40 ref.

Descriptors: *Basalts, *Hydration, *Ion exchange, *Mineralogy, *Water chemistry, Distribution patterns, Leaching, Solubility, Elements (Chemical), Sea water, Weathering, Chemical reactions.
Identifiers: *Oceanic basalts.

Analysis of 112 deep ocean basalts reported in the literature show systematic chemical trends in major elements with distance from ridge spreading centers. These same trends are observed in the weathering of single pillows and produce a chemical composition similar to volcanic alkali basalts. Upon hydration by sea water, tholeiitic ridge basalts give off silica, calcium, magnesium, and gain potassium, iron, titanium, manganese, sodium and phosphorus. Aluminum shows no apparent change. The yearly contribution to sea water in nanograms of the major elements per cc of basalt is estimated at Si—..7.4, Ti—-1.6, Fe—-3.3, Mn—0.06, Mg—..2.3, Na—-0.21, Ca—..2.1, K—-0.9, and P—-0.14. (Knapp-USGS)
W71-03956

SOME CHARACTERISTICS OF THE THERMAL REGIME OF RIVERS IN THE DANUBE AND DNIESTER BASINS,
N. G. Dyukel.
Translated from Trudy UkrNIGMI, No 85, 1969, p 104-111. Soviet Hydrology: Selected Papers, No 4, p 381-387, 1969. 7 p, 4 fig, 4 tab, 5 ref.

Descriptors: *Water temperature, *Climates, *Altitude, *Surface-groundwater relationships, *Thermal pollution, Surveys, Data collections, Hydrologic data.
Identifiers: *USSR, *River thermal regime.

The thermal regime of rivers in the Tissa, Seret, Prut, and Dniester basins, USSR, is determined by climatic conditions and, primarily, by air temperature. The strongest disturbances are observed in reaches where groundwater discharges. The thermal regime is also strongly affected by human activity, such as the discharge of warm industrial waters into rivers, river regulation by ponds and reservoirs, etc. To characterize the thermal regime of rivers, an analysis was made of natural and artificially disturbed regimes in a thermal survey. The natural thermal regime was analyzed separately for river reaches with strong and with moderate groundwater recharge. The relationship between air and water temperatures was found to be single-valued on river reaches with moderate groundwater recharge. The thermal regime in such reaches varies with latitude in lowland rivers and with elevation in the mountain rivers. The air temperature lapse rate is 0.7 deg C, while the vertical water temperature gradients of rivers in the Dniester basin is 1.6 deg C and in the Danube basin 1.3 deg C. In the cold months (January-March, November, December), the vertical water temperature gradient practically drops to zero. The greatest scatter of points is observed for the warm months (May-September) when the thermal regime is affected even by insignificant local factors, when the difference between the ground and river-water temperatures is the greatest. (Knapp-USGS)
W71-03974

SPECTROPHOTOMETRIC DETERMINATION OF CHLORATE ION,
Missouri Univ., Columbia. Dept. of Chemistry.
Norman L. Trautwein, and John C. Guyon.
Analytica Chimica Acta (Amsterdam), Vol 41, p 275-282, 1968. 8 p, 7 fig, 1 tab, 7 ref.

Descriptors: *Chemical analysis, *Spectrophotometry, *Chlorides, *Methodology, *Test procedures, Analytical techniques, Research and development, Chemistry, Evaluation, Instrumentation, Ions, Chemical reactions, Absorption, Laboratory tests, Ionization.
Identifiers: *Chemical analysis (Chlorate ion).

A simple, direct, sensitive spectrophotometric method for the determination of chlorate ion is described. The method is based upon the interference of chlorate ion on the formation of a rhenium-alpha-furildioxime complex, whose absorbance maximum is at 532 millimicrons. The effect of several variables is described. The range for the method is 0-5.0 parts per million of chlorate ion. A variety of ions were added to the system in order to study interferences. The principal interferences are copper, thiocyanate, tungstate and uranyl ions. Copper and uranium increase the absorbance and diminish the interference of the chlorate ion. Thiocyanate ion produces a yellow color with perrhenate in the presence of tin chloride. Tungstate forms a precipitate on the addition of tin chloride. (Woodard-USGS)
W71-03994

SURFACE CHEMISTRY STUDIES ON THE BAY OF PANAMA,
Naval Research Lab., Washington, D.C.
For primary bibliographic entry see Field 02L.
W71-04001

QUALITY OF SURFACE WATERS OF THE UNITED STATES, 1965: PARTS 7 AND 8. LOWER MISSISSIPPI RIVER BASIN AND WESTERN GULF OF MEXICO BASINS.
Geological Survey, Washington, D.C.

For sale by Superintendent of Documents, US Government Printing Office, Wash, DC 20402 - Price $3.50. Geological Survey Water-Supply Paper 1964, 1970. 819 p, 1 fig, 32 ref.

Descriptors: *Water quality, *Surface waters, *Mississippi River Basin, *Data collections, *Hydrologic data, Chemical analysis, Water temperature, Sediment transport, Suspended load, Sediment discharge, Particle size, Sediment load, Streamflow, Water properties, Water chemistry, Sampling, Laboratory tests, On-site investigations, Runoff, Flow rates.
Identifiers: *Lower Mississippi River Basin, *Western Gulf of Mexico Basins.

During the water year ending September 30, 1965, the U. S. Geological Survey maintained 127 stations on 61 streams for the study of chemical and physical characteristics of surface water in the lower Mississippi River Basin and Western Gulf of Mexico Basins. Samples were collected daily and monthly at 125 of these locations for chemical-quality studies. Samples also were collected less frequently at many other points. Water temperatures were measured continuously at 2 and daily at 83 stations. Quantities of suspended sediment are reported for 34 stations. Sediment samples were collected one or more times daily at most stations, depending on the rate of flow and changes in stage of the stream. Particle-size distributions of sediments were determined at 22 of the stations. Descriptive statements for the basic-data tables are given for each regular sampling station. These statements include location of the station, drainage area, periods of records available, extremes of dissolved solids, hardness, specific conductance, temperature, sediment loads, and other pertinent data. Records of discharge of the streams at or near the sampling station are included in most tables of analyses. (Woodard-USGS)
W71-04048

STRUCTURE OF WATER IN MICROEMULSIONS: ELECTRICAL, BIREFRINGENCE, AND NUCLEAR MAGNETIC RESONANCE STUDIES,
Florida Univ., Gainesville. Dept. of Chemical Engineering; and Florida Univ., Gainesville. Dept. of Anesthesiology.
For primary bibliographic entry see Field 01B.
W71-04108

ARSENIC IN POTABLE DESERT GROUNDWATER: AN ANALYSIS PROBLEM,
Naval Weapons Center, China Lake, Calif. Michelson Labs.; and Boron Community Services District, Calif.
G. C. Whitnack, and H. H. Martens.
Science, Vol 171, No 3969, p 383-385, January 29, 1971. 3 p, 2 fig, 2 tab, 12 ref.

Descriptors: *Arsenic compounds, *Analytical techniques, *Trace elements, *Water pollution, *Groundwater basins, *California, Hydrogeology, Deserts, Potable water, Mineral water, Water analysis, Methodology, X-ray fluorescence, Adsorption, Water chemistry.
Identifiers: *Analysis problem, Arsine evolution, Mohave Desert.

As the result of conflicting reports made in 1969 on the arsenic content of drinking water from groundwater sources in the Mohave Desert, a comprehensive study was made of the analytical methods in use. Results of this study and of the consequent investigation of metal interference in the arsine (AsH_3) evolution step are described. Gallon samples of water collected from each of 24 sites were analyzed within 30 days of collection, using techniques of x-ray fluorescence and single-sweep polarography. Data reported by the SDDC method were confirmed for certain of the well waters. Groundwaters of the Boron and China Lake basins are associated with many water-soluble minerals and are more brackish or briny than the usual surface waters for which the colorimetric SDDC method was developed. It is concluded that interference with the evolution of arsine in the American Public Health Association silver diethyldithiocarbamate method used in the 1969 analyses caused either color enhancement or arsine suppression, and this method is unreliable for certain natural water types. (Lang-USGS)
W71-04109

A CASE STUDY OF MICROORGANIC CONTAMINANTS IN RIVER WATER,
Mellon Inst., Pittsburgh, Pa.; and Virginia State Water Control Board, Richmond.
For primary bibliographic entry see Field 05A.
W71-04119

STUDY OF MOLYBDENUM IN PUBLIC WATER SUPPLY,
Denver Board of Water Commissioners, Colo.
For primary bibliographic entry see Field 05A.
W71-04120

THE BACKGROUND CONCENTRATIONS OF COPPER, LEAD, AND ZINC IN STREAMS OF THE 'NEW LEAD BELT', MISSOURI,
Missouri Univ., Rolla. Dept. of Geology.
For primary bibliographic entry see Field 05A.
W71-04182

THEORETICAL MEAN ACTIVITY COEFFICIENTS OF STRONG ELECTROLYTES IN AQUEOUS SOLUTIONS FROM 0 TO 100 DEG C,
National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.
For primary bibliographic entry see Field 01B.
W71-04183

MINERAL RECOVERY FROM CONCENTRATED BRINES,
Brigham Young Univ., Provo, Utah.
Joseph M. Glassett.
Fore sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. Price $0.75. Office of Saline Water Research and Development Progress Report No 593, December 1970. 79 p, 17 fig, 8 tab, 13 ref, 2 append. OSW Grant 14-01-0001-1302.

Descriptors: *Brines, *Brine disposal, *By-products, *Phase diagrams, *Ultimate disposal, Sodium chloride, Potassium compounds, Magnesium compounds, Sodium sulfate salts, Solubility, Aqueous solutions.
Identifiers: Mineral recovery, Phase rule processes.

Several mineral recovery processes are proposed for study to profitably recover valuable minerals from the concentrated brine effluent of saline water conversion plants. Phase rule processes appear particularly attractive since no raw materials are needed except the brine itself. The principal process studied involves: (1) solar evaporation to 1.27 specific gravity to remove sodium chloride from the brine, (2) dilution with 15 volume per cent fresh water, (3) cooling to -15C to recover pure mirabilite crystals, (4) a second evaporation to 1.29 specific gravity to remove additional sodium chloride, (5) dilution with 5 volume per cent fresh water, (6) a second cooling to recover pure sylvite, and (7) a third evaporation to recover carnallite and a strong MgCl2 brine. The yield of sylvite was found to be low so as alternative process is suggested. This alternative process involves omitting the second dilution and cooling steps. The second evaporation in three stages can produce halite, sylvinite, and carnallite. Sylvite may be recovered from sylvinite and from carnallite by present commercial methods. The residue brine will contain principally magnesium chloride. When sea water brine was evaporated to a magnesium concentration of four weight per cent or more, pure epsomite was obtained during the first cooling step instead of mirabilite. (Scott-Office of Saline Water)
W71-04223

2L. Estuaries

WATER QUALITY - BENTHIC INVERTEBRATE RELATIONSHIPS IN ESTUARIES,
Maine Univ, Walpole, Ira C. Darling Center for Research, Teaching and Service.
For primary bibliographic entry see Field 05C.
W71-03922

THE PERIODIC CYCLE OF PARTICULATE MATTER IN A SHALLOW, TEMPERATE ESTUARY,
New Hampshire Univ., Durham. Jackson Estuarine Lab.
Franz E. Anderson.
Journal of Sedimentary Petrology, Vol 40, No 4, p 1128-1135, December 1970. 8 p, 10 fig, 11 ref.

Descriptors: *Sediment transport, *Suspended load, *Organic matter, *Estuaries, *Water circulation, Tidal effects, Streamflow, Regime, Salinity, Water temperature, Ice, Freezing, Mud flats, Intertidal areas, New Hampshire, Winds, Waves (Water).
Identifiers: Bellamy River Estuary (NH).

The concentration of particulate matter in the Bellamy River estuary, New Hampshire has been observed to be strongly periodic over tidal cycles in the spring and early summer months and weakly periodic or aperiodic during the rest of the year. The variation in periodicity appears to be a function of changing estuarine circulation patterns with river discharge, and the protection of the tidal flat by ice and slush during the winter months. (Knapp-USGS)
W71-03943

MINERAL AND CHEMICAL COMPOSITION OF SEDIMENTS FROM THE STRAITS OF FLORIDA,
Atlantic Oceanographic and Meteorological Labs., Miami, Fla.
For primary bibliographic entry see Field 02J.
W71-03944

DEPOSITIONAL AND DISPERSAL DYNAMICS OF INTERTIDAL SAND BARS,
Illinois Univ., Urbana. Dept. of Geology.
For primary bibliographic entry see Field 02J.
W71-03948

SAND WAVES AND TIDAL CHANNELS IN THE ENTRANCE TO CHESAPEAKE BAY,
Old Dominion Univ., Norfolk, Va. Inst. of Oceanography.
John C. Ludwick.
Virginia Journal of Science, Vol 21, No 4, p 178-184, 1970. 7 p, 6 fig, 20 ref. ONR Contract No N00014-70C-0083.

Descriptors: *Sedimentary structures, *Sand waves, *Tidal waters, *Bays, *Channel flow, Channel morphology, Alluvial channels, Currents (Water), Flow characteristics, Sands, Sand bars, Profiles, Waves (Water), Shoals, Sediment transport, Velocity, Shear stress.
Identifiers: *Chesapeake Bay entrance, *Tidal channels.

Sand waves 5-12 feet in height and 200-1200 feet in length occur in water 25-50 feet deep in the sand bank and tidal channel area of the entrance to Chesapeake Bay. Most waves are asymmetrical in transverse profile, some facing with ebb currents, others facing with flood currents, depending on which is dominant at a given place. Steep slopes on the various waves range from 4 to 21 deg and average 12 deg. The sand waves occur in association with tidal channels and especially on the flanks of shoals that form channel boundaries. Migration of sand waves, judged from their facing direction, is a bed sediment transport mechanism by which sand is moved up onto shoals. Many large shoals of the area occur between ebb-dominated and flood-dominated channels. This implies the existence of net circulation loops of water and sediment in cells located over shoals. The action of such cells is to trap sediment. Other ebb-flood shear zones may mark sites of future shoaling in the entrance. (Woodard-USGS)
W71-03958

ESTIMATION OF SEA SURFACE TEMPERATURE FROM SPACE,
Michigan Univ., Ann Arbor. Inst. of Science and Technology.
For primary bibliographic entry see Field 07B.
W71-03959

SURFACE CHEMISTRY STUDIES ON THE BAY OF PANAMA,
Naval Research Lab., Washington, D.C.
J. D. Bultman, W. D. Garrett, N. L. Jarvis, and J. B. Romans.
Available from NTIS as AD-713 142, $3.00 in paper copy, $0.95 in microfiche. Memorandum Rept. No NRL-MR-1435, June 1963. 15 p, 10 fig, 1 tab, 2 ref.
Identifiers: *Sea water, *Surface-active substances, *Monomolecular films, *Oceans, Interfaces, Chemical analysis, *Surface chemistry, *Panama Bay.

A field trip was made to the Bay of Panama during the week of April 8 through April 12, 1963. The purpose of the trip was to carry out experiments dealing ultimately with the surface chemistry of the sea. Surface and subsurface water samples were collected to determine the nature of the adsorbed films that occur on the sea and to learn more of their origin. Experiments were also carried out to determine the rate of adsorption of surface active material at the sea/air interface, and to determine force-area curves for the stable film forming constituent. Efforts were also made to measure in a given small area the percent coverage of the sea by surface active material. In addition, measurements were made of the film pressure of slick covered areas, and an attempt was made to correlate these measurements with the changes in surface potential. Each experiment is discussed briefly in this report with appropriate conclusions and recommendations.
W71-04001

UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME I. STATE-OF-THE-ART OF OCEANOGRAPHIC AND METEOROLOGICAL SENSORS, TUTORIAL DISCUSSION,
Texas Instruments, Inc., Dallas. Services Group.
For primary bibliographic entry see Field 07B.
W71-04009

UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME II. STATE-OF-THE-ART OF OCEANOGRAPHIC AND METEOROLOGICAL SENSORS, CATALOG,
Texas Instruments, Inc., Dallas. Services Group.
For primary bibliographic entry see Field 07B.
W71-04010

UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME III. THE SURVIVAL ENVIRONMENT FOR OCEANOGRAPHIC AND METEOROLOGICAL SENSORS,
Texas Instruments, Inc., Dallas. Services Group.
For primary bibliographic entry see Field 07B.
W71-04011

UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME IV. THE FORMATTING AND TRANSMISSION OF DATA FROM OCEANOGRAPHIC SENSORS,
Texas Instruments, Inc., Dallas. Services Group.
For primary bibliographic entry see Field 07B.
W71-04012

UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME V. ANALYSIS OF APPLYING STANDARDIZATION TECHNIQUES TO OCEANOGRAPHIC SENSORS,
Texas Instruments, Inc., Dallas. Services Group.
For primary bibliographic entry see Field 07B.
W71-04013

UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME VI. TEST REQUIREMENTS FOR OCEANOGRAPHIC AND METEOROLOGICAL SENSORS,
Texas Instruments Inc., Dallas. Services Group.
For primary bibliographic entry see Field 07B.
W71-04014

COST OF PATUXENT RIVER QUALITY MONITORING,
Geological Survey, Arlington, Va.
For primary bibliographic entry see Field 05A.
W71-04115

03. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

POROUS TUBULET SUPPORTS FOR DESALINATION BARRIERS,
DeBell and Richardson, Inc., Hazardville, Conn.
Bernard Baum, Roy A. White, W. H. Holley, W. R. Diehl, and R. C. Trudeau.
For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D.C. 20402 Price $1.00. Office of Saline Water Research and Development Progress Report No. 604, December 1970. 98 p, 17 tab, 20 fig, 7 ref. OSW Contract 14-01-0001-2211.

Descriptors: *Reverse osmosis, *Separation techniques, Pressure, Desalination processes, Membrane processes, *Osmosis.
Identifiers: Membrane supports, *Support tubes, Microporous supports.

Rigid micrporous thermoplastic materials have been developed on a laboratory scale, the best of which, a PVC (polyvinyl chloride) homopolymer, has been successfully extruded into tubulets. These polyvinyl chloride tubulets were leached in water to give porous tubulets which had the desired pore size and reasonable flux. Porous materials in flat sheet form were formulated with a number of polymers and screened for porosity, flux and pore size. The porosity in these materials was produced by compounding water-soluble liquids, salts, resins, or gums into the various rigid thermoplastics, molding them into flat sheets, and extracting the water-soluble materials to produce porous, water-permeable sheets. Water flux was determined by passing distilled water through the sheets at 20-40 psig pressure in a Gelman stainless steel pressure filter funnel, and collecting the effluent in a graduated cylinder. Pore size was established in a preliminary manner by determing if either 1 micron (10,000A) or 0.2 micron (2,000A) latex particles would pass through the sheet or tubulet. Several lots of 0.060' and 0.030' outside diameter polyvinyl chloride tubulets containing polyvinyl methyl ether and a surfactant as the water-leachable components were extruded. One series was extruded from milled compound and the other, to reduce thermal degradation, was extruded from dry blend. (Kindley-Office of Saline Water)
W71-03911

WATER TRANSPORT THROUGH PLASTICIZED MEMBRANES,
Weizmann Inst. of Science, Rehovoth (Israel).
D. Vofsi, and O. Kedem.
For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D.C. 20402 Price $0.65. Office of Saline Water Research and Development Progress Report No. 591, December 1970. 60 p, 15 tab, 9 fig. OSW Contract 14-01-0001-961.

Descriptors: Desalination, Ion exchange, Ion transport, Membranes, *Membrane processes, Permselective membranes, *Reverse osmosis, *Semipermeable membranes, Separation techniques, *Osmosis.
Identifiers: Hyperfiltration, Pressure dialyais.

'Liquid' and 'plasticized' solvent membranes are of interest as possible analogues of biological systems. Semipermeable homogeneous films are prepared by plasticizing polyvinylchloride with organic phosphates. Water permeability of such films is relatively high. Conditioning of a 'plasticized' membrane, under the osmotic gradient of solution of sodium nitrate leads to profound although usually reversible changes in its morphology and to a drastic increase of its water permeability. Their reversibility in various solutions may be correlated with the respective differences in permselectivity. Porous charged membranes were prepared previously by crosslinking polypeptides in a collodion matrix. Using the same technique polylysine and polyvinylamine can be used as polyelectrolytes, whereas Procion Brilliant Orange MG acts as crosslinking agent. This material can either crosslink polyamines or bind them to a cellulosic matrix. Membranes prepared by this method permit high rate fluxes, but the salt rejection is quite low. However, good separation between hydrochloric acid and copper chloride are obtained in the same membranes; while the acid concentrates in the product, most of the salt remains in the feed. (Kindley-Office of Saline Water)
W71-03912

EVALUATION OF THE VERTICAL TUBE EVAPORATOR AND THE MULTISTAGE FLASH DESALINATION PROCESSES.
Fluor Corp. Ltd., Los Angeles, Calif.

For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D.C. 20402 Price $4.25. Office of Saline Water Research and Development Progress Report 580, August 1970. 226 p. OSW Contract 14-01-0001-1830.

Descriptors: *Cost comparisons, *Design criteria, *Desalination processes, *Flash distillation, *Long-tube vertical distillation, Water costs, Capital costs, Desalination, Desalination plants, Distillation, Evaporators, Desalination apparatus, Heat balance, Thermodynamic behavior, Saline water.
Identifiers: *Enhanced surface tubes, Corrugated tubes.

The objectives of this study were to determine, compare and evaluate the relative thermodynamic and engineering characteristics and economics of the Vertical Tube Evaporator (VTE) and the Multistage Flash (MSF) desalination processes. Also, included was a determination and assessment of the relative reliability, maintainability, and potentials of the two types of plants. Capital costs and operating costs were determined and are reported in detail. The main conclusions of the study were: (1) for large size plants (250 mgd) a VTE plant appears to have a distinct economic advantage over the corresponding MSF design; (2) the use of enhanced surface (corrupted) tubes in a large MSF plant would reduce its cost, although the cost of the VTE plant would still be substantially lower; and (3) for plants of 2.5 MGD size, capital costs and production costs for the two types of plants evaluated (VTE and MSF) are very nearly the same, however, the use of enhanced surface tubes in the MSF plant could make that process more economical. (Van Doren-Office of Saline Water)
W71-03913

DEVELOPMENT OF ECONOMICAL METHODS OF BORON REMOVAL FROM IRRIGATION RETURN WATERS,
Aerojet-General Corp., El Monte, Calif.
For primary bibliographic entry see Field 05D.
W71-03914

BOLSA ISLAND NUCLEAR POWER AND DESALTING PROJECT FACILITIES (COST AND DESCRIPTION) AND COST OF DESALTED WATER,
Southern California Metropolitan Water District, San Diego.
Henry J. Mills.
For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D.C. 20402. Price $2.50. Office of Saline Water, Research and Development Progress Report No. 570, August 1970. 119 p, 26 tab, 2 fig, 19 plates, 3 ref. OSW Contract 14-01-0001-1290.

Descriptors: *Desalination plants, *Flash distillation, *Nuclear powerplants, Dual-purpose, Desalination, *Costs.
Identifiers: Desalting costs.

The purpose of this report is to review the Bolsa Island desalination project supported jointly by the Metropolitan Water District of Southern California, Office of Saline Water, Atomic Energy Commission and three power utilities in the area: The project called for an overall system with seawater desalting plant of 150 mgd capacity and a nuclear power plant with a projected output of 1900 mw. The project was terminated before any construction was started. However, extensive plant, site and economic studies were completed. This report reviews these activities with particular emphasis on cost projections for the plant and resulting water cost. Special features of the report are the man-made island to be used as a plant site (opposite Bolsa Chica State Park), the combined nuclear power desalting system, projected designs for flash distillation plant, the water delivery system and the detailed cost analysis made. (Sieveka-Office of Saline Water)
W71-03915

ENGINEERING EVALUATION OF FACTORS AFFECTING QUALITY OF WATER SOURCES AVAILABLE FOR SALINE WATER CONVERSION PLANTS,
Powell (Sheppard T.) and Associates, Baltimore, Md.
Frank C. Di Luzio, John W. Heintz, and Charles L. Gransee.
Available from NTIS as PB-194 028, $0.95 in microfiche. For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D.C. 20402. Price $1.75. Office of Saline Water Research and Development Progress Report No. 168, Dec. 1965. 258 p, 497 ref. OSW Contract 14-01-0001-378.

Descriptors:
Identifiers: *Desalting, *Water supply, *Water reclamation, Desalting, *Sewage, Water reclamation, Water treatment, Oceans, Brackish water, Oxidation, Coagulation, Adsorption, Sewage treatment, Water resources, Industrial wastes, Microorganisms, *Waste water treatment.

Experience in the development of saline water conversion facilities has clearly established the importance of water quality to the technology and economics of process and plant design. The overall objective of the investigation has been to determine the effects of contaminated raw water supplies on conversion processes, and to study potential technical and economic advantages of combination saline water and sewage effluent conversion plants. The nature of the project has been that of an engineering study and evaluation, and did not involve any experiments to determine water quality effects. Sources of saline water are considered individually and include ocean waters, coastal harbors and estuaries, and saline groundwaters. (See also W70-01545)
W71-03916

MEMBRANE MATERIALS FOR WASTE WATER RECLAMATION BY REVERSE OSMOSIS,
Gulf General Atomic, San Diego, Calif.
For primary bibliographic entry see Field 05D.
W71-04185

SECOND REPORT ON HORIZONTAL-TUBE MULTIPLE-EFFECT PROCESS PILOT PLANT TESTS AND DESIGN,
Universal Desalting Corp, New York.
R. B. Cox, G. A. Matta, A. S. Pascale, and K. S. Stromberg.
For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. Price $1.50. Office of Saline Water Research and Development Progress Report No 592, May 7, 1970. 128 p, 20 fig, 3 ref, 3 append. OSW Contract 14-01-0001-2247.

Descriptors: Design criteria, Dropwise condensation, Films, Pilot plants, Evaporation, *Heat transfer, Distillation, *Desalination.
Identifiers: Experimental data, Extended heat transfer surfaces, Film evaporation, Film condensation, Heat transfer improvements, Boiling promotion, Heat transfer coefficients, *Horizontal tube evaporators, *Multiple effect distillation, Non-condensable removal.

A single-effect test unit at the OSW Wrightsville Beach Plant as described in OSW R and D Progress Report No. 492 has been automated for continuous operation. Data obtained during previous short-duration tests were confirmed by continuous operation and by a specific 500-hour run. The factors that influence the overall heat transfer coefficient were further delineated. The effect of various surface enhancements on the heat transfer coefficient was determined and coefficients two to three times those in LTV smooth tubes were obtained. A 3-effect test unit was designed to determine the parameters associated with inter-effect operation and to demonstrate the adequacy of designs for larger sized plants. The report contains a description of this 3-effect test unit together with a discussion of the operating parameters and design innovations to be demonstrated future tests.

W71-04220

THE USE OF AMALGAM ELECTRODES TO MEASURE ACTIVITY COEFFICIENTS IN MULTICOMPONENT SALT SOLUTIONS,
Tyco Labs., Inc., Waltham, Mass.
For primary bibliographic entry see Field 01B.
W71-04221

FABRICATION OF FELT-MEMBRANE COMPOSITES,
General Aniline and Film Corp., Greenwich, Conn. Industrial Products Div.
Arthur C. Wrotnowski, and Edward G. Bernard.
For sale by Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. Price $1.00. Office of Saline Water Research and Development Progress Report No 599, September 1970. 47 p, 20 fig, 5 tab, 26 ref, 4 append. OSW Contract 14-01-0001-2106.

Descriptors: *Desalination, *Reverse Osmosis, *Membrane processes, *Porous Media, *Porosity, *Desalination apparatus, Osmosis.
Identifiers: *Felt-membrane composites, Plate and frame apparatus, Composite membranes, Membrane compaction.

Studies were made of felt-membrane composites to determine their suitability for use in the reverse osmosis desalination process. Impregnated felts were found to have acceptable mechanical and flux transmission properties to serve as a membrane support. A Loeb-type membrane cast on impregnated felt was also found to operate normally, i.e. the solution did not 'strike in', the osmotic face and porous back formed properly and annealing was amenable. A Loeb-type membrane cast on impregnated felt ran for thirty days (760 continuous operating hours) with the following results: (A) a flux reduction slope of 0.026 GFD per day. (B) an extrapolated total life of 2.2 years. (C) a steadily improving salt injection. The cost of generating potable water employing an impregnated felt plate and frame desalination system was calculated to be as follows: (A) one stage brackish water $0.24/1000 gallons. (B) two stage sea water $0.68/1000 gallons. (C) one stage sea water $0.32/1000 gallons. (Horowitz-Office of Saline Water)
W71-04222

MINERAL RECOVERY FROM CONCENTRATED BRINES,
Brigham Young Univ., Provo, Utah.
For primary bibliographic entry see Field 02K.
W71-04223

THE STRUCTURE AND MORPHOLOGY OF INORGANIC MEMBRANES,
Baylor Univ., Waco, Tex.
W. O. Milligan, M. Uda, M. L. Beasley, Dennis R. Dillin, and Wayne E. Bailey.
For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. Price $0.75. Office of Saline Water Research and Development Report No 594, December 1970. 82 p, 10 tab, 43 fig, 102 ref. OSW Grant 14-01-0001-1296.

Descriptors: *Membranes, *Semipermeable membranes, *Dialysis, Osmosis, Membrane processes, Desalination.
Identifiers: *Inorganic membranes, Ferrocyanide salts, Membrane structure.

The structure and morphology of the classic semipermeable membrane, cupric ferrocyanide, and some 40 other heavy metal ferro-, ferri-, and cobalti-cyanides were studied by isobaric dehydration, x-ray and electron diffraction, low angle electron diffraction, infra-red, and Mossbauer spectroscopy. Freshly precipitated cupric ferrocyanide gel was found to be composed of 10 A amorphous particles that age under water to become crystalline within 10 to 15 minutes. After about 20 hours, platelike particles appear, exhibiting new diffraction lines corresponding to a larger cubic unit cell, and yielding a step-wise dehydration isobar. In the absence of the plates, this cupric ferrocyanide complex exhibits a bivarient dehydration isobar similar to some 30 other cyanide complexes studied. The pore structure of heavy metal cyanide complexes was found to consist of interstices between spheroidal or platelike particles, with the morphology more significant than the particle size. Hydrated cupric ferrocyanide is unique in forming sheets, assumed to be the active semi-permeable structure, water being transported through the channel like interstices, regular in this case, but irregular in membranes composed of spheroidal particles. (Leiserson-Office of Saline Water)
W71-04224

REVERSE OSMOSIS DESALTING STATE-OF-THE-ART (1969).
Hittman Associates, Inc., Columbia, Md.

For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. Price $0.75. Office of Saline Water Research and Development Progress Report No 611, October 1970. 73 p, 10 tab, 23 fig, 16 ref. OSW Contract 14-01-0001-1748.

Descriptors: Desalination, *Reverse Osmosis, Economics, Waste water treatment, *Osmosis, *Membranes, Membrane processes, Costs, Desalination plants, *Revies, *Desalination apparatus, Separation techniques.
Identifiers: Reverse osmosis plants.

The report reviews current technical and engineering economic aspects of the reverse osmosis (RO) desalting process. The RO process is a viable technique for the desalting of brackish water feed. Research indicates that seawater desalting is possible but not yet practical. Brackish water production plants with capacities up to 100,000 gpd are operational. Economical RO desalting is strongly dependent upon the operating performance and economic characteristics of the membrane and its support structure. Much of the attractiveness of the RO process is associated with the low energy consumption requirements. Projections of costs are made for plants up to 50 million gallons per day of product water. (Sturza-Office of Saline Water)
W71-04225

ABSTRACTS OF LITERATURE ON THE DISTILLATION OF SEAWATER AND ON THE USE OF NUCLEAR ENERGY FOR DESALTING.
Oak Ridge National Lab., Tenn.

For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. Price $2.00. Office of Saline Water Research and Development Progress Report No 589, September, 1970. 280 p. OSW Contract 14-30-2535.

Descriptors: *Abstracts, *Desalination, Distillation, *Documentation, Indexing, Desalination plants, Desalination processes, Water utilization, Energy, *Bibliographies.
Identifiers: Industrial applications.

Abstracts are given for approximately 1200 published articles related to the desalination of seawater. The body of the report is a copy of information stored in a computerized storage and retrieval system on desalination at the Oak Ridge National Laboratory. The abstracts are grouped in nine categories. Author and keyword indexes to the articles referenced are provided. The keywords, which identify the content of the articles, were chosen from a thesaurus developed at ORNL.
W71-04226

PROGRESS IN WATER DESALINATION TECHNOLOGY,
Desert Inst., Ashkhabad (USSR).
M. V. Kolodin.

Trans From Problemy Osvoyeniya Pustyn', 1970, No 3, p 64-72. Soviet Georgraphy: Review and Translation, Vol 11, No 10, p 858-864, December 1970. 1 fig, 4 tab, 15 ref.

Descriptors: *Water supply, *Desalination processes, *Hydrologic budget, *Cost-benefit analysis, *Water costs, Arid lands, Distillation, Electrodialysis, Flash distillation, Long-tube vertical distillation, Separation techniques, Vapor compression distillation, Energy dissipation, Dual purpose, Electric power production, Evaporators, Economic feasibility, Freezing, Heating, Runoff, Surface waters, Technology, Technical feasibility, Research and development, Water pollution effects, Water utilization, Water reuse, Domestic water, Industrial water.
Identifiers: *USSR, *Atomic reactors.

Originally, human water supply problems existed only in the hot, arid regions, but by the middle of the 20th century, they also existed in highly industrialized urban areas. The earth's annual runoff is 37, 130 cu.km., of which mankind is now using about 10% (3,308 cu.km.), divided between irrigation (2,500 cu.km.) and domestic and industrial uses (563 cu.km.). The major concern is not so much increasing consumption levels as water pollution, and current data suggests that increased pollution will soon create severe water shrotages. Natural water costs are rising as a result of additional treatment needs and diversion from remote areas. It is felt that the solution lies in more thorough treatment processes combined with increasing desalination. Research and development efforts in desalination processes were relatively late in beginning in the Soviet Union, but from 1963-1967, 10 large, producing plants were built, mostly in arid areas. In 1963 the first large 4-chamber long-tube distillation plant was completed at Shevchenko (KazakhSSR) and had a capacity of 5000 cu.m./day, a cost of 143 kopecks/cu.m. and a power consumption of 0.19 billion cal./cu.m. By 1967 a 5-stage flash distillation plant had been built in Krasnovodsk with a capacity of 1200 cu.m./day and a cost of 72 kopecks/cu.m. A secondary refrigerant freezing plant is being designed to have a capacity of 36,000 cu.m./day with a cost of 24.3 kopecks/cu.m. It is felt that dual purpose plants combining saline water conversion with electric power production, are particularly economical. (Casey-Arizona)
W71-04229

DRY LANDS AND A HUNGRY WORLD,
Oak Ridge National Lab., Tenn.
For primary bibliographic entry see Field 06B.
W71-04291

3B. Water Yield Improvement

CLOUD SEEDING POTENTIALITIES IN LOS ANGELES COUNTY.
North American Weather Consultants, Pasadena, Calif.

Los Angeles County Flood Control District, Los Angeles, Report 15-1, October 1952. 102 p, 12 fig, 9 tab.

Descriptors: *Cloud seeding, *Cloud physics, *Meterology, *Storm structure, *Artificial precipitation, *Rain, Precipitable water, Weather patterns, Storm structure, Silver iodide, Chemistry of precipitation, Water supply, Storm runoff, Water resources, Hydrologic cycle, Cost-benefit analysis, California.
Identifiers: *Los Angeles County, San Gabriel Mountains.

Cloud seeding methods are discussed for both winter and summer seasons and the economic value of a program is estimated for Los Angeles County. Historical weather records, characteristics of Southern California storms and the physical factors underlying naturally and artificially produced precipitation are examined. Final conclusions and

recommendations are that cloud seeding in Los Angeles County is economically feasible, self supporting, and safe if carried out on a controlled plan basis. It appears that this is true with respect to both winter and summer seeding. It is recommended that cloud seeding be confined to the San Gabriel Range and the desert region to the North thereof in the winter and to the San Gabriel Range in the summer. Furthermore, it is recommended that ground generators be used in winter, and that ground generators be used in conjunction with aerial operations in the summer. Although systematic seeding can be expected to produce precipitation increases of the order of between 20 to 40 percent, a limited seeding plan is recommended. This plan would produce in an average year a minimum of 6500 acre feet of salvable storm flow, worth at least $130,000, plus an additional 20,000 acre feet of sustained summer flow worth over $500,000. (Poertner)
W71-03903

WATER SUPPLY OUTLOOK FOR THE WESTERN UNITED STATES, 1970-71 WATER YEAR.
National Weather Service, Silver Spring, Md. Office of Hydrology.
For primary bibliographic entry see Field 02B.
W71-03927

THE RELATIONSHIP BETWEEN SUMMER LOW FLOWS AND GEOLOGY IN NORTHLAND, NEW ZEALAND,
Ministry of Works, Wellington (New Zealand). Water and Soil Div.
For primary bibliographic entry see Field 02A.
W71-03931

A MORE RIGOROUS EXPRESSION FOR THE RATE OF DROPLET GROWTH,
Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
Richard D. H. Low.
Available from NTIS as AD-713 559, $3.00 in paper copy, $0.95 in microfiche. 1970. 13 p, 4 fig, 15 ref.
Identifiers: *Artificial precipitation, Mathematical analysis, *Water vapor, Condensation, Nucleation, Vapors, Diffusion, Integration, Weather modification.

One facet of weather modification is the dissipation of a warm fog or the improvement of visibility within it by means of seeding with condensation nuclei. The analysis of the effectiveness of this type of nuclei finds its roots in the mathematical expression for condensational growth - one of the few fundamental equations in cloud physics which has, only during the past twenty years, been recognized as a distinct branch of physical meteorology and, more recently, as an integral part of atmospheric physics. Being a young science, cloud physics has embodied areas of study which are in need of better understanding and further development, one such area being the processes of condensation and precipitation. The fundamental equation is applicable to the growth of an isolated and immobile saturated solution droplet in a stationary medium of moist air. It is the purpose of this paper to examine this equation critically from a theoretical point of view.
W71-04005

OPTIMAL ALLOCATION OF STOCHASTIC WATER SUPPLY,
California Univ., Riverside. Dry-Lands Research Inst.; and New South Wales Univ., Kensington. School of Civil Engineering.
Warren A. Hall, and David T. Howell.
Journal of the Irrigation and Drainage Division, ASCE, Vol 96, No IR4, p 395-402, December 1970. 8 p, 1 tab, 6 ref, 2 append.

Descriptors: *Optimization, *Stochastic processes, *Linear programming, *Dynamic programming, *Water allocation (Policy), Constraints, Streamflow, Regulated flow.
Identifiers: *Nonlinear system.

An example of the use of water rights as a social constraint was presented for an arid or semiarid agricultural region such as exists in much of the southwestern portion of the United States. It was presumed that the quantity of water which will be available in any year could be assessed with reasonable accuracy at the beginning of the growing season of that year. The particular device used was the allocation of the probability of receiving water rather than the allocation of water per se. First, allocation of stochastic water supply by a linear system was described. A series of linear programming problems, each with one constraint, was shown in tabular form. The use of dynamic programming as an alternate procedure was developed in the section on nonlinear systems. The problem of solving real optimal water-allocation was resolved by allocating the probability of receiving water, i.e., the seniority of the right rather than the water alone. The probability used represented the stochastic component of a stream-flow. Since the method concerned the residual stochastic component, first the net returns from the regulated, or nonstochastic, portion of the flow were produced by the project and then, the difference between the optimal return from the residual unregulated (stochastic) flow and the optimal return from the original unregulated flow were added algebraically so as to make a more precise evaluation of a particular project proposal. No attempt was made to apply the method to a municipal-industrial system. (Kriss-Cornell)
W71-04028

THE EFFECT OF VEGETATION CONVERSION AND FLOOD DISCHARGE ON STREAM CHANNEL GEOMETRY: THE CASE OF SOUTHERN CALIFORNIA WATERSHEDS,
California Univ., Los Angeles.
For primary bibliographic entry see Field 04D.
W71-04230

INCREASES IN WATER YIELD FOLLOWING CLEAR-CUT LOGGING IN THE PACIFIC NORTHWEST,
Forest Service (USDA), Portland, Oreg. Pacific Northwest Forest and Range Experiment Station.
Jack Rothacher.
Water Resources Research, Vol 6, No 2, p 653-658, April 1970.

Descriptors: *Water yield improvement, *Clear-cutting, *Vegetation effects, Small watershed, Watershed management, Coniferous forest, Mountain forests, Lumbering, Oregon.
Identifiers: *Experimental watersheds.

Increases in water yield following timber harvest roughly conform to the proportion of the area cleared. In high precipitation areas of the Oregon Cascades, clear-cut logging can increase annual water yield 18 inches. Approximately 80% of the increase occurs during the October to March season. (Rothacher-Forest Service)
W71-04240

THE HYDROLOGY OF SAGEBRUSH LANDS AND THE MANAGEMENT OF BLOWING SNOW,
Forest Service (USDA), Laramie, Wyo. Rocky Mountain Forest and Range Experiment Station.
Ronald D. Tabler.
Hydrology Seminar, University of Wyoming, Proceedings, p 11-15, June 25-26, 1970.

Descriptors: *Research facilities, *Sagebrush, *Snow management, Soil-water-plant relationships, Water yield improvement, Snowpacks, Wyoming.
Identifiers: *Snow fences.

The hydrology of sagebrush lands and the effects of sagebrush control on water yield are being studied by the Rocky Mountain Forest and Range Experiment Station at the Wayne's Creek Watersheds (elev. about 9500 ft) near Dubois, Wyoming, and at the Stratton Study Area (elev. about 7500 ft) near Saratoga. At both of these areas, watersheds of 60 to 1600 acres are instrumented for streamflow, precipitation, snow storage, sediment yields, soil moisture, climatic data, and vegetative production and ground cover. On the Pole Mountain Study Area, near Laramie, snow fences are being tested as a means of increasing snow accumulation and snowmelt runoff. A snow fence 12 1/2 ft tall and 1300 ft long, built during the summer of 1969, is expected to about double snow accumulation on the 111-acre watershed. Effects of this treatment on snow accumulation, total annual streamflow, and seasonal distribution of flow will be studied over the next five years. (Tabler-Forest Service)
W71-04248

SUMMARY OF SNOW RESEARCH BY THE ROCKY MOUNTAIN FOREST AND RANGE EXPERIMENT STATION AT LARAMIE, WYOMING.,
Forest Service (USDA), Laramie, Wyo. Rocky Mountain Forest and Range Experiment Station.
For primary bibliographic entry see Field 02C.
W71-04249

WATERSHED MANAGEMENT IN THE UNITED STATES: CONCEPTS AND PRINCIPLES,
Forest Service (USDA), Logan, Utah. Intermountain Forest and Range Experiment Station.
P. E. Packer, and W. A. Laycock.
New Zealand Agr Eng Inst, Lincoln College, Canterbury, New Zealand, Lincoln Papers in Water Resources No 8, Part 1, p 1-22, 1969. 60 ref.

Descriptors: *Water yield improvement, *Water quality, *Water yield, *Watershed management, *Watersheds, Phreatophytes, United States.
Identifiers: *Watershed protection, *Watershed rehabilitation, Forest watersheds, Range watersheds.

Without doubt, the most important watershed problems for which management solutions are needed are those concerned with how to continue timber harvesting, grazing, mining and recreational uses of watersheds without causing undue damage to soil and water. Increasing pressures from an expanding population for the multiple uses afforded by our forest and range watersheds emphasize the need for accelerated research to provide answers and for more intensive management application of those answers. Of more immediate danger to soil and water are those problems concerned with restoration of satisfactory hydrologic and soil stability conditions to damaged watersheds; however, these problems are not nearly so widespread as--and, therefore, are not of equal importance with--the watershed maintenance problems. Not only is research needed to further develop and refine requirements for such restoration but management must also demonstrate greater willingness to make the investments necessary to rectify damaging effects on soil and water of past misuses and abuses. Finally, of somewhat less urgency--but nevertheless of still great importance--are those problems concerned largely with manipulation of vegetation to influence the amount, quality, and timing of water yields delivered as streamflow from forest and range watersheds. (Packer, Forest Service)
W71-04253

3C. Use of Water of Impaired Quality

IMPROVING EFFICIENCY IN AGRICULTURAL WATER USE,
Colorado State Univ., Fort Collins. Natural Resources Center.
W. D. Kemper.

Available from NTIS as PB-197 264, $3.00 in paper copy, $0.95 in microfiche. Completion Report, Series No 20, Environmental Resources Center, July 31, 1970. 10 p. OWRR Project B-008-Colo (12).

Descriptors: *Evaporation, *Salinity, Soil texture, Surface crusts, Salt tolerance, *Osmosis, Electro-osmosis, Hysteresis, Dispersion, *Saline soils, Soils.
Identifiers: Dispersion coefficients, Onsager reciprocal relations, Gravel mulches, Wetting methods, Salt gradients, Anomalous osmosis.

Salinity is a factor in most of the western soils. Evaporation of water in the soils leaves the salt concentrated in the remaining solution, building up large concentration gradients even in soils containing relatively low concentrations of total soluble salts. These salt gradients can affect water movement both by acting osmotically and by changing the soil structure and water absorption capabilities. The mechanisms of osmosis were delineated, hydrodynamic dispersion coefficients were determined, and effects of these salt gradients on evaporation were determined. NaCl decreased evaporative CaCl2 tended to increase evaporation. Thin dense crusts of the type formed by raindrop action tended to reduce evaporation when overlying looser soil with larger pores. The mechanisms of osmosis are so involved with ion type, mineral type, structure, and texture that much more work is needed to sort out all the interactions and develop predictive criteria.
W71-04049

PROGRESS IN WATER DESALINATION TECHNOLOGY,
Desert Inst., Ashkhabad (USSR).
For primary bibliographic entry see Field 03A.
W71-04229

3D. Conservation in Domestic and Municipal Use

A STUDY OF WATER USE IN SINGLE-DWELLING RESIDENCES IN THE CITY OF CALGARY, ALBERTA, ALBERTA UNIV., EDMONTON (CANADA),
Alberto Univ., Edmonton. Dept. of Agricultural Economics and Rural Sociology.
Richard L. Kellow.
University of Alberta Agricultural Economics and Rural Sociology, Ph D Thesis, Thesis Report, No 1, May 1970. 175 p, 29 tab, 12 fig, 67 ref, 2 append.

Descriptors: *Municipal water, Domestic water, Water rates, Measurement.
Identifiers: *Calgary.

Through random sampling of domestic water consumers in Calgary, Alberta the author was able to study the effect of flat rate versus metered rate water pricing systems. He concluded that households on a flat rate average substantially greater water use than metered households. The study also revealed the existence of a large variance of water consumption between households in the same socio-economic class, but the seasonal peaking increases faster than average water use as the value of the home and income increases. (Holmes-Rutgers)
W71-04287

3F. Conservation in Agriculture

DEVELOPMENT OF ECONOMICAL METHODS OF BORON REMOVAL FROM IRRIGATION RETURN WATERS,
Aerojet-General Corp., El Monte, Calif.
For primary bibliographic entry see Field 05D.
W71-03914

INFLUENCE OF LOW RATES OF WATER APPLICATION BY SPRINKLERS ON THE MICROCLIMATE,
South Dakota State Univ., Brookings. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 02D.
W71-03925

WATER MEASUREMENT PROCEDURES - IRRIGATION OPERATORS' WORKSHOP.
Bureau of Reclamation, Denver, Colo. Engineering and Research Center.
For primary bibliographic entry see Field 08B.
W71-04007

ASPECTS OF THE SOUTH AUSTRALIAN CITRUS INDUSTRY,
Memorial Univ. of Newfoundland, St. John's. Dept of Geography.
Peter Crabb.
Scottish Geographical Magazine, Vol 86, No 1, p 41-51, April 1970. 4 fig, 3 tab, 18 ref.

Descriptors: *Citrus fruits, *Irrigation systems, *Crop production, *Marketing, *Economic efficiency, Semiarid climates, Temperature, Environmental effects, Irrigation effects, Salinity, Economic feasibility, Distribution systems, Sprinkler irrigation, Productivity, Fruit crops, Grapefruit, Oranges, Cost-benefit analysis, Water utilization, Land use, Labor, Costs, Quality control.
Identifiers: *South Australia, *Production costs.

Australia is not as yet a major citrus producing country, and South Australia accounts for only 25% of Australian citrus production. In the past 20 years, however, the rate of increase of citrus production has been far greater in South Australia than any other state and still has much potential citrus land currently unexploited. The quality of the citrus is also high. South Australia's major advantages are extensive irrigation schemes and freedom from insect pests due to climatic aridity and very stringent quarantine regulations. However, several problems are beginning to develop: (1) increasing production bringing a rising proportion of poor-quality fruit due to greater numbers of young trees, (2) a temperature regime unfavorable for grapefruit production, (3) overuse of N fertilizers, (4) salt accumulation owing to application of highly saline Murray River water by overhead sprinkler systems, (5) high labor costs, (6) decreases in world citrus prices, (7) inefficient packing and handling practices, and (8) inefficient distribution and marketing systems. Recently legislation has been passed creating a Citrus Organization Committee, which is concentrating on improved administration of the industry, collection of statistical and technical data, and marketing. The prognosis for the future is highly favorable. (Casey-Arizona)
W71-04051

GEOGRAPHICAL ASPECTS OF THE USE OF WATER RESOURCES IN THE SOVIET ECONOMY,
Akademiya Nauk SSSR, Moscow. Institut Geografii.
K. V. Dolgopolov.
From: Izvestiya Akademii Nauk SSSR, Seriya Geograficheskaya, 1969, No 6, p 38-46. Soviet Geography: Review and Translation, Vol 11, No 9, p 737-745, November 1970. 4 tab, 15 ref.

Descriptors: *Water conservation, *Water supply, *Competing uses, *Irrigation practices, *Industrial water, Crop production, Economic feasibility, Semiarid climates, Cost-benefit analysis, Planning, Soil conservation, Grains (Crops), Geographical regions, Water resources, Regional analysis, Productivity, Water allocation (Policy), Water distribution (Applied), Water costs, Water pollution effects, Water requirements, Water users, Irrigable land, Wheat, Agriculture, Water demand.
Identifiers: *USSR.

The steppe and wooded steppe regions of the eastern USSR play a key agricultural role, producing over 80% of the nation's grain crop. In terms of total yield, yield/acre, production costs and direct labor inputs, they are far superior to Siberia and Kazakhstan. As part of a national program of increasing agricultural production, present plans call for an increase of almost 100% in grain production in the steppe areas. However, these regions are characterized by an unstable water supply. In the wooded steppe this problem can be alleviated by improved water and soil conservation measures, but in the steppe zone, irrigation will be absolutely necessary. This problem is complicated by the presence of a large number of high water-use industries in these zones. The author argues that the requirements of agriculture should be given priority in these areas and the practice of industrial location in highly agricultural regions should be discontinued. The far eastern regions of the USSR have no agriculture and are water-rich, and would therefore be much better industrial areas. (Casey-Arizona)
W71-04052

FARMING, FOREST AND SAVANNA IN WESTERN NIGERIA,
Birmingham Univ. (England). Centre for West African Studies.
W. B. Morgan, and R. P. Moss.
Erdkunde, Vol 24, No 1, p 71-80, Marz 1970. 6 fig, 2 tab, 16 ref.

Descriptors: *Grasslands, *Forests, *Farm management, *Crops, *Economic feasibility, Social impact, Ecosystems, Ecology, Environmental effects, On-site data collections, Biological communities, Human population, Tropical regions, Rainfall, Temperature, Climatic data, Drought tolerance, Soil types, Soil chemical properties, Biogeography, Land development, Grasses, Vegetation, Soil surveys, Urbanization, Humid climates, Rice, Tobacco, Water utilization, Agriculture, Variability, Spatial distribution.
Identifiers: *West Africa, *Nigeria, *Cassava, *Developing countries, *Agroclimatology, Cocoa, Yams, Bananas, Location factors.

Crop plants alter their environment and are in turn acted upon by the environment. For this and other reasons, it is argued that agricultural development planning and descriptions of spatial variability should not proceed only on the basis of simple surveys of native vegetation. In Western Nigeria the savanna-forest boundary is not abrupt. Islands of forest extend for a considerable distance into the savanna. A survey of farm holdings was conducted in 1966, in the hope that it would reveal some of the factors involved in crop choices, particularly on holdings which included both forest and savanna land. The physical factors of temperature, rainfall, natural vegetation and year-round growing conditions are described, as are the social factors of farm sizes and locations relative to towns, land ownership, labor problems and the general impact of urbanization on rural areas. Commercial crops were much more extensive than crops for domestic consumption, and were shipped to the cities. Cocoa was the dominant crop in forest areas and cassava was dominant in savanna areas. The 3 major crops systems were: (1) root crops - banana-tree crops, confined to the forest, (2) maize-cassava-yams, occurring in both areas and (3) Guinea corn-root crops system, confined to the savanna. Other crops such as rice and tobacco occurred only in areas where appropriate processing facilities were available. Forest land clearance presents a major problem because of the rainly seasons. Relatively moist areas are used for growing high-priced yams where economically feasible. It is concluded that crop choices are made on the basis of a variety of economic, social and biological factors and no simple distinction occurs between forest and savanna agriculture. (Casey-Arizona)
W71-04054

FEEDING A DESERT CITY: ANTOFAGASTA, CHILE,
Southern Connecticut State Coll., New Haven. Dept. of Geography.
Martin I. Glassner.
Economic Geography, Vol 45, No 4, p 339-348, October 1969. 2 fig, 5 tab.

Descriptors: *Arid lands, *Food abundance, *Economic feasibility, *Transportation, *Social aspects, Legal aspects, Deserts, Urban sociology, Import, Moisture availability, Geographical regions, Social impact, Harbors, Railroads, Distribution, Access routes, Roads, Road construction, Moisture deficit, Food habits, Climatic zones, Highway effects, Environmental effects, Limiting factors, Area development, Federal government, Attitudes, Industries, Public health, Social change, Water demand, Livestock, Prices, Agriculture.
Identifiers: *Chile, *Atacama desert, *Oases, *Antofagasta.

Antofagasta is a seaport in the heart of the Atacama, perhaps the world's driest desert. Since the only food production in the Atacama is at scattered oases, the city, with a population of 125,000, has severe food import problems. It is, however, favored by an abundant supply of fresh water and special import privileges. The major sources of food supply are: (1) imports, both from within and outside of Chile via ship, railroad and truck, (2) produce grown at the interior oases, (3) seafood acquired by inefficient, primitive methods and (4) livestock grown in limited numbers within the city. Food prices are generally high and most of the population suffers from an inadequate diet. A special law allows into the province a large number of foreign food imports forbidden to the rest of the country. The imports are taxed and the revenue is used in various projects designed to improve the food supply. These include modernization of the fishing industry and oasis agriculture, improvement of transport facilities to the city and improvement of food storage and distribution facilities within the city. Counterparts of this city are found in ill-fed desert communities around the world and it is hoped that its experiences will serve as guidelines to other areas beset by the problems of severe water-deficiency. (Casey-Arizona)
W71-04055

SUPERFARMS VS. SAGEBRUSH: NEW IRRIGATION DEVELOPMENTS ON THE SNAKE RIVER PLAIN,
Portland State Univ., Oregon.
David Lawrence Smith.
Association of American Geographers, Proceedings, Vol 2, p 127-131, 1970. 9 ref.

Descriptors: *Irrigation practices, *Land reclamation, *Crop production, *Pumping, *Social change, Desert Land Act, Irrigation systems, Irrigation efficiency, Idaho, Alfalfa, Potatoes, Sugar beets, Sorghum, Barley, Arid lands, Sagebrush, Sands, Sprinker irrigation, Flood irrigation, Irrigation ditches, Land development, Political constraints, History, Legal aspects, Social aspects, Irrigable land, Water delivery, Farm management, Potations, Farm units, Cost benefit analysis, Economic feasibility, Economies of scale, Economic prediction, Federal government, Rivers, Flood plains.
Identifiers: *Bureau of land management, *Bureau of reclamation, *Snake River.

Most of the Snake River Plain is traversed by the River in a narrow canyon up to several hundred feet deep; only occasionally does the canyon widen enough for a flood-plain. The natural vegetation is a sagebrush-grass association and all environmental factors except rainfall are favorable for crop production. Irrigation projects in the area were started over 100 years ago and until 1950 were largely a result of federal involvement. Since 1950 the combination of crop prices, technical improvements in water pumps and private investment have resulted in a steady increase of land reclamation by pumping water several hundred feet up onto the plain from the Snake River. This has resulted in large, isolated farming units usually in absentee ownership. The older farms are smaller, family-oriented, require less capital and often occupy federal reclamation projects. The major crops are potatoes, barley and sugar beets. The success of the large-scale operations since 1960 ensures an adequate source of private development capital. Most of the currently undeveloped land is owned by the federal government and its acquisition by private groups has been complicated by legal and political factors. Water supplies for support of future developments seem adequate. The author forsees a doubling of irrigated land in the future. (Casey-Arizona)
W71-04056

THE SAM SIMON WATERSHED: SHRUB CONTROL,
Arizona Univ., Tucson. Coll. of Agriculture.
Gilbert L. Jordan, and Michael L. Maynard.
Progressive Agriculture in Arizona, Vol 22, No 5, Sept-Oct 1970, p 6-9. 6 fig, 2 tab, 3 ref.

Descriptors: *Soil management, *Watershed management, *Range management, *Brush control, *Vegetation regrowth, Plant populations, Shrubs, Phreatophytes, Erosion control, Arroyos, Soil-water-plant relationships, Gullies, Forage grasses, Soil moisture, Germination, Root systems, Mechanical control, Mesquite, Droughts, Arizona, Arid lands, Grazing, Planting management, Cacti, Desert plants, Watersheds (Basins), Competition, Balance of nature, Equipment.
Identifiers: *Perennial grass cover, Pitted chaining, Disk plowing, Root plowing, Seedling, San Simon Valley (Arizona), Semiarid lands, Creosotebush.

The San Simon Valley, a frail watershed in southeastern Arizona, is subject to excessive soil movement and arroyo formation as a result of mismanagement, over-grazing and drought. This semiarid region (less than 9.5 inches annual precipitation) is dominated by shrubs, mainly sand-dune mesquite, creosotebush and tarbush. Perennial grass cover is composed of sideoats, grama, black grama, bush muhly, spike and mesa dropseed, sacaton, Arizona cottontop, plains bristle-grass, and cane beardgrass. Vegetation improvement for erosion protection and increased forage production requires shrub removal and grass planting. Shrub removal is necessary in semiarid rangelands because shrubs use limited moisture necessary for seedling establishment and germination. Brush control study sites were selected from typical cattle-grazed rangeland and were subsequently fenced. The Bowie site has creosotebush and sand-dune mesquite communities. The communities have extensive lateral root systems and deep tap roots, which collect windblown sand. The San Simon site has communities of sand-dune mesquite, creosotebush, tarbush, and four-wing saltbush. Seeding studies, mechanical shrub control and complete to moderate brush eradication were performed during the 1963 to 1966 period. Fourwing saltbush, a palatable browse plant, was not well controlled. Soil moisture was an important factor in brush control, since mechanical control tends to be more effective when moisture is low. Root and disk plowing and pitted chaining effectiveness is shown in two tables; six photographs show typical vegetation and shrub control techniques. (Popkin-Arizona)
W71-04058

ROOTSTOCKS FOR VALENCIA ORANGES AND LIBSON LEMONS IN ARIZONA,
Arizona Agricultural Experiment Station, Yuma; and Arizona Agricultural Experiment Station, Phoenix, Salt River Valley Citrus Farm.
D. R. Rodney, R. M. Allen, and R. H. Hilgeman.
Progressive Agriculture in Arizona, Vol 22, No 5, Sept-Oct 1970, p 10-11. 2 fig, 2 tab.

Descriptors: *Oranges, *Lemons, *Citrus fruits, *Crop response, *Plant diseases, Boron, Chlorine, Iron, Nutrients, Fruit crops, Loam, Fungi, Viruses, Growth stages, Salts, Irrigation water, Saline water, Calcium, Soil types, Irrigated land, Arizona, Arid lands, Dissolved solids, Resistance, Plant growth, Sands, Crop production.
Identifiers: *Rootstocks, *Adaptivity, Irrigated crops, Zinc, Aphids.

Irrigated citrus fruits are an important crop in Arizona. Factors which complicate selection of rootstocks for citrus trees are physical characteristics of calcium content and soil, salts in the irrigation water, rootstock adaptation to soil, calcium, salts and responding growth and fruiting responses, and rootstock tolerance to viral and fungal diseases. The major cause of citrus tree deaths in Arizona is root rot or brown rot gummosis, caused by the fungus Phytophtora. Very few viruses causing tristeza are present in Arizona, though aphid populations are seasonly common. A chart shows advantages and disadvantages of 10 common rootstocks for Valencia oranges and Lisbon lemons. Rough lemon scions produce large yields on sandy soils and loam of large fruit with large total soluble solids. A susceptibility chart describes tolerance to quick decline, cachexia, scaly butt and foot rot as well as nutrient tolerance of 10 common rootstocks. Expected rootstock responses to iron and zinc deficiencies, and chlorine and boron excesses are also indicated. (Popkin-Arizona)
W71-04059

ELEVATION AND TEMPERATURE EFFECTS ON SEVERITY OF MAIZE DWARF MOSAIC VIRUS IN SORGHUM,
Arizona Univ., Tucson. Coll. of Agriculture.
R. B. Hine, W. E. Osborne, and R. E. Dennis.
Progressive Agriculture in Arizona, Vol 22, No 5, Sept-Oct 1970, p 14-16. 1 fig, 3 tab, 12 ref.

Descriptors: *Elevation, *Air temperature, *Viruses, *Sorghum, Irrigated land, Parasitism, Plant diseases, Johnsongrass, Arizona, Arid lands, Environmental effects, Temperature, Resistance, Crop production, On-site investigations, Crop response, Moisture.
Identifiers: *Maize Dwarf Mosaic Virus (MDM), *Irrigated crops, *Disease severity, *Crop losses, *Hybrids, Aphic vector populations, Cochise County (Arizona).

Sorghum is one of Arizona's most important irrigated crops. During 1968 and 1969, 200,000 irrigated acres were grown at elevations from near sea level to over 5,000 feet, equally divided between the southeastern and central parts of the state. Full season hybrids, planted at high elevations in May and harvested in October and November, exceeded 6,000 pounds per acre-above the state average of 4,400 pounds. Sorghum was grown without serious parasitic diseases until a Maize Dwarf Mosaic (MDM) virus epidemic in 1968 extended to all producing counties. Serious losses were caused only at elevations over 4,000 feet in 1968 and 1969. MDM outbreak in Cochise County in 1968 was related to high aphid vector populations, Johnsongrass prevalence, unusually cool summer and large acreages planted to susceptible hybrids. This paper explains differences in disease severity at different elevations and times. Several replicated field plots established in areas of various elevations were evaluated in sorghum response to MDM. High summer temperatures and use of resistent hybrids reduced disease severity in the 1969 field studies. Observations from 1967 to 1970 show low air temperatures related to serious disease development in susceptible hybrids. MDM was serious only aboe 4,000 feet only during the cool 1968 summer, though MDM was common at low elevations during this period. Aphid and Johnsongrass control is expensive and difficult. Temperature is uncontrollable and unpredictable. Hybrid choice, controlled by the grower, is the means of MDM control. Figures and tables show field test results, temperature comparisons and elevation temperature relationships. (Popkin-Arizona)
W71-04060

MINERALOGY OF SOME ARID AND SEMIARID LAND SOILS OF IRAQ,
Wisconsin Univ., Madison. Geological and Natural History Survey.
For primary bibliographic entry see Field 02G.
W71-04061

CLIMATE AND OVERGRAZING ON THE SHONTO PLATEAU, ARIZONA,
Alberta Univ., Edmonton.
Ian A. Campbell.
Professional Geographer, Vol 22, No 3, p 132-141, May 1970. 5 fig, 3 tab, 30 ref.

Descriptors: *Grazing, *Arid lands, *Climatology, *Vegetation effects, *Arizona, Arroyos, Precipitation (Atmospheric), Vegetation establishment, Climatic data, History, Environmental effects, Ecology, Sheep, Temperature, Indian reservations, Dendrochronology, Erosion, Drought, Biological communities, Sagebrush, Grasses, Shrubs, Plant populations, Canyons, Gully erosion, Topography, Rainfall disposition, Elevation, Ecosystems, Carrying capacity, Variability, Data collections, Seasonal, Livestock, Soil erosion.
Identifiers: *Shonto Plateau (Arizona), *Vegetation zones, Plant pests, Russian Thistle.

The Shonto Plateau area of northern Arizona undergoes wide annual temperature variations but has year-long grazing potential because of a double-maximum annual precipitation pattern. Due to a century-old grazing history and a record of climatic aridity patterns in the middle and late 19th century and in the 1930's, the area may lend clues to the oldest problem of the Southwest--the nature of the effects of overgrazing and climatic change on native vegetation and arroyo-cutting. The Bureau of Indian Affairs, which administers the area, has emphasized the them of overgrazing-vegetation-destruction-soil erosion without giving consideration to climatic variability. The area is now covered by pure stands of Russian thistle (Salsola kali), which documentary evidence indicates did not appear until the 1920's in any high numbers. Probably it was originally encouraged by favorable moisture conditions, and when overgrazing and aridity cycles combined to reduce competition from native grasses, it became dominant. Many gully existent in the 1930's no longer exist or are stablized. Apprently, overgrazing has not resulted in accelerated gully erosion. Some climatic factor, possibly summer rain intensity, is probably presently unfavorable for gully formation. (Casey-Arizona)
W71-04064

WATER TABLE DECLINE AND RESULTANT AGRICULTURAL PATTERNS IN THE SALT RIVER VALLEY OF ARIZONA,
Kansas State Coll. of Pittsburg. Dept. of Geography.
Joseph Pifer.
Journal of Geography, Vol 68, No 9, p 545-549, December 1969. 2 fig.

Descriptors: *Water table, *Arizona, *Withdrawal, *Irrigation practices, *Agriculture, Crop production, Economic feasibility, Arid lands, Irrigation wells, Water allocation (Policy), Groundwater mining, Groundwater recharge, Groundwater basins, Pumping, Irrigation districts, Developed waters, Cost trends, Cost-benefit analysis, Grains (Crops), Cotton, Citrus fruits, Forages, Water costs, Allotments, Alfalfa, Deep wells, Aquifers, Alluvium, Water resources, Wells, Legislation, Potatoes, Gravitational water.
Identifiers: *Salt River Valley (Arizona), *Salt River Project, *Groundwater Act (Arizona), Grapes.

The water resources of the Eastern Salt River Valley of Arizona have been intensively developed, resulting in the conversion of unproductive desert to extensive croplands. However, this vast development was sustained by large scale groundwater withdrawals and in the past 30 years the water level has declined from 100 feet to approximately 475 feet below the surface, although some gravity water is now available from the Salt River Project and no new irrigation wells have been drilled in critical areas since the Groundwater Act of 1948. Farms in the area obtain water from different sources with varying costs and accordingly, grow differing crops. The 3 crop-water source classes are: (1) irrigation districts supplied by both well and gravity water at an average cost of 10 dollars/acre-foot growing small grains and forage crops; (2) irrigation districts supplying pumped water with high initial cost citrus orchards and grapes which provide high cash returns and (3) privately owned and operated wells where water costs run as high as 15 dollars/acre-foot, growing cotton and potatoes. As water costs increase, more farmers turn to higher value crops. Probably the marginal areas will be abandoned as water costs become too great to produce cotton and potato crops economically. (Casey-Arizona)
W71-04065

MICROBIAL POPULATIONS IN STUBBLE-MULCHED SOIL,
Agricultural Research Service. Northern Plains Branch; and Nebraska Univ., Lincoln. Agricultural Experiment Station.
For primary bibliographic entry see Field 02G.
W71-04068

ENGINEERING FEASIBILITY DEMONSTRATION STUDY FOR MUSKEGON COUNTY, MICHIGAN, WASTE WATER TREATMENT-IRRIGATION SYSTEM.
Muskegon County Board, Mich. Dept. of Public Works.
For primary bibliographic entry see Field 05D.
W71-04186

NEW APPROACHES TO IRRIGATED FARMING IN THE SUDAN: ORGANIZATION AND MANAGEMENT,
Leeds Univ. (England). Dept. of Agricultural Economics.
I. G. Simpson.
Land Economics, Vol 46, No 3, p 287-296, August 1970. 2 tab, 3 ref.

Descriptors: *Crop production, *Social impact, *Economic efficiency, *Irrigation systems, *Land tenure, Land use, Land management, Social aspects, Economic feasibility, Farm units, Foreign countries, Administrative agencies, Administrative costs, Irrigation water, Arid lands, Manpower, Political aspects, Cooperatives, Leases, Pumping, Water costs, Rent, Cotton, Planning, Irrigation districts.
Identifiers: *Sudan, *Developing countries, Nile River, Gezira System.

The principal irrigated areas of the Sudan lie along the Blue and White Nile Rivers, and several new projects are currently in the planning stages. The oldest irrigation scheme is the gravity-fed Gezira of about 2 million acres, which was established by the British in 1913. The social and political organization of land tenancy, land development and water provision became an amalgam of state control and private enterprise known as the 'Gezira System'. Tenants are allocated holdings of a fixed number of acres and the holding rights are inheritable. To facilitate mechanized operations and close supervision, the holdings consist of a number of strips in separate fields which were originally only cotton fields. The management of the scheme is highly centralized, and uniform regulations for cropping decisions, land management practices, etc., are not determined at the local level. This results in administrative cost efficiencies, but introduces little progress because of inertia through lack of incentives to individual tenants, conservative decision-making and lack of emphasis on technical leadership. Innovation and flexibility are therefore lacking. Further, population numbers have increased faster than holdings, creating a downward pressure on sizes of individual holdings. In early days of the scheme, the communal system was successful, but the author feels it has outlived it's usefulness. A careful analysis here should furnish guidelines for the organization of future water project schemes. (Casey-Arizona)
W71-04231

IRRIGATION DEVELOPMENT IN TUNISIA,
California State Coll., Long Beach. Dept. of Geography.
Edward Karabenick.
Tijdschrift voor Economische en Sociale Geografie, Vol 60, No 6, p 360-368, November/December 1969. 3 fig, 12 ref.

Descriptors: *Salinity, *Irrigation systems, *Irrigation practices, *Crop production, *Developed waters, Social aspects, Social impact, Political aspects, Cost-benefit analysis, Planning, Evaluation, Environmental effects, Irrigation effects, Dams, Urbanization, Groundwater, Regional analysis, Watersheds (Basins), Administrative agencies, Arid lands, Droughts, Water allocation (Policy), Water districts, Water policy, Water quality, Water resources, Water supply, Water users, Salinity, Farms, Agriculture, Municipal water.
Identifiers: *Tunisia, *Developing countries, *Mejerda River, *Agricultural development, Grapes, Olives.

Although it is a major sector of the Tunisian economy, farming is overburdened by technological immaturity and population pressures. Most of the country is arid, and even the narrow, humid coastal band is subject to periodic droughts. The Mejerda River drainage basin represents 60% of the nation's total irrigation potential, but because of unfavorable terrain, only the upper and lower parts of the Mejerda Valley are suitable for agricultural redevelopment. Because of physical and social factors, development efforts have differed in the 2 areas. Owing to its proximity to the rapidly expanding Tunis area, the lower valley, has lost much water to the Greater Tunis water system. Saline water and saline soils are critical problems limiting crop potential. Agrarian reform has resulted in the evolution of private ownership, and a large number of cooperative village settlements have been built. While the irrigated area of the upper valley will not be as great, it may be more productive. The available surface water of the northern Mejerda tributaries may be supplemented by groundwater resources and large cooperatively owned farms are being developed. The division in administration between the 2 valleys has not abetted coordinated planning of total Mejerda basin development. Further, the uneconomic aspects of a third development, the Oued Nebaana Project, indicate the importance of political as well as economic factors. (Casey-Arizona)
W71-04232

AN ECONOMIC ANALYSIS OF LEVEL BENCH SYSTEMS FOR FORAGE PRODUCTION IN NORTH DAKOTA,
Economic Research Service, Fargo, N. Dak.
Wallace McMartin, Howard J. Haas, and Wayne O. Willis.
Conservation Research Report No 14, USDA, March 1970. 21 p, 6 fig, 11 tab, 23 ref.

Descriptors: *Irrigation practices, Water conservation, Snow management, Alfalfa, Economics, *Cost-benefit analysis, North Dakota, *Forages, Agronomic crops.
Identifiers: *Northern Great Plains, Mandan (N Dak), Level bench systems.

Economic benefits to be gained by constructing a level bench system for growing several field crops in North Dakota are described. Since the Northern Great Plains is a dry area, these level benches would serve to conserve the snow so that it could be added to the available water supply for the crop. At the Northern Great Plains Research Center at Mandan, North Dakota, level bench experiments were conducted with various crops, with various width benches, on various gradients of slopes. This paper reports that financial returns for alfalfa

grown with level benches are considerably increased, while for grass, wheat and corn either small benefits or none at all were found. (Holmes-Rutgers)
W71-04265

THE IMPACT OF AGRICULTURAL CHANGE ON A LOCAL ECONOMY IN THE GREAT PLAINS,
Colorado State Univ., Fort Collins.
Melvin D. Skold, and Arthur J. Greer, Jr.
Colorado State University Experiment Station, Technical Bulletin 106, October 1969. 24 p, 2 fig, 13 tab, 21 ref.

Descriptors: *Planning, *Water management (Applied), *Water conservation, *Economic impact, *Input-output analysis, Resource development, Linear programming, Computer programs, Computer models, Water supply, Irrigation efficiency, Irrigation programs, Consumptive use, Expenditures, Water allocation (Policy), Economic prediction, Estimating, Kansas, Colorado, Great Plains, Model studies, Analytical techniques, Income, Agriculture, Farms.
Identifiers: *Agricultural change, *Great Plains Conservation Program, Semiarid lands.

An input-output local economic model was constructed for a 9-county area in northwestern Kansas and east-central Colorado--a semiarid, groundwater irrigation, agricultural region. Impact of irrigation development on agriculture is analyzed by a recursive linear programming model. Irrigation development produces additional purchases of processing services, capital inputs and retail items. The derived demands for these agricultural services become inputs to the input-output model which estimates irrigation-development impact. The region, the analytical model and model applications are discussed. The Great Plains Conservation Program and irrigation development produced marginal changes in income and additional consumer expenditures in accord with the marginal propensity to consume. Unless regional income change is major, the number of firms and volume of employment will not increase greatly. This analytical techniques may be applied to other areas to analyze resource development and programs and yield useful results. Thirteen tables present input-output data. (Popkin-Arizona)
W71-04289

IRRIGATION AS A FARM GROWTH STRATEGY,
North Dakota State Univ., Fargo. Dept. of Agricultural Economics.
Carl E. Olson, and Joseph H. Paulson.
North Dakota Agricultural Experiment Station, Bulletin 486, October 1969. 11 p, 2 fig, 12 tab, 5 ref.

Descriptors: *Farm management, *Irrigation efficiency, *Water resources development, *Economic efficiency, *Water conservation, Net income, Dry farming, Income analysis, Farm prices, Pasture management, Livestock, Irrigated land, North Dakota, Surveys, Economic impact, Gross income, Variability.
Identifiers: *Economic growth, *Economic survival, *Income stability, Interviews, Questionnaires, Lower Yellowstone Soil Conservation District (North Dakota), Garrison Diversion Project (North Dakota), Semi-arid lands.

Irrigated farming in semiarid regions increases chances of survival and economic growth. This report compares and evaluates organizational and operational strategies of irrigation, livestock and mixed farm-operator groups in North Dakota. The development of Garrison Diversion Project encourages interest in irrigation in the state. The Lower Yellowstone Soil Conservation District with 39,088 irrigable acres, is studied by way of 89 questionnaires to operators and follow-up interviews. Mixed or livestock groups have a greater positive change in net worth and a higher rate of economic growth than the irrigation group. Mixed and livestock groups operated more variable and diversified farms, with similar amounts of irrigated acreage, dry cropland and pasture acreage. Irrigated enterprises on a dryland operation add stability to income and increase the economic growth rate. Figures and tables locate the study area and correlate gross farm income, type and total acreage, and assets for irrigation, livestock and mixed groups. (Popkin-Arizona)
W71-04290

THE PUMPED WELL,
Colorado Agricultural Experiment Station, Fort Collins.
For primary bibliographic entry see Field 04B.
W71-04292

ALTERNATIVE CROP ENTERPRISE BUDGETS FOR IRRIGATED PRODUCTION, SOUTHWESTERN OKLAHOMA,
Oklahoma State Univ., Stillwater. Dept. of Agricultural Economics.
Charles O. Hopkins, and Vernon R. Eidman.
Oklahoma Agricultural Experiment Station, Project 1358: Economic Efficiency in the Allocation of Irrigation Water Over Time. Oklahoma Agricultural Experiment Station, Agricultural Research, Processed Series P-600, January 1969. 74 p, 1 fig, 70 tab, 26 ref.

Descriptors: *Crop production, *Irrigation efficiency, *Economic justification, *Economic prediction, *Oklahoma, Farm management, Cultural control, Cultivation, Irrigable land, Irrigation practices, Water management (Applied), Water requirements, Fertilization, Planting management, Cost allocation, Decision making, Limiting factors, Water allocation (Policy), Water supply, Water demand, Water costs, Water shortage, Economic efficiency, Economic impact, Unit costs, Prices, Leases, Resource development, Return (Monetary), Operating costs, Groundwater, Productivity, Cost benefit analysis, Irrigation systems.
Identifiers: *Resource requirements, Custon rates.

Estimates of costs and returns for groundwater-irrigated crops in 11 southwestern Oklahoma counties are presented. Such estimates of resource requirements, costs and returns provide decision makers with data to allocate efficiently the limited water supply to alternative crops. Seeding rates, fertilization and irrigation levels, crop yields, tillage practices, and custom rates were obtained by interviews with agricultural personnel. Prices were obtained from published sources and retailers. Irrigable soils were divided as loam, clay and sand, then subdivided by productivity level. Of the 769,629 irrigable acres, 202,800 acres were irrigated in 1967 of which 120,140 acres were irrigated by groundwater. Three irrigation levels were considered. Production values of each budget list yield per acre, price per yield unit, and product gross value. Total specified costs include non-labor variable production costs. Costs and return estimates for owner operators may be reduced to tenant operating under a leasing arrangement. Seventy tables present economic data on irrigated production. (Popkin-Arizona)
W71-04294

WATER AND CULTURE: NEW DECISION RULES FOR OLD INSTITUTIONS,
Arizona Univ., Tucson. Bureau of Ethnic Research.
For primary bibliographic entry see Field 06E.
W71-04296

THE DEVELOPMENT OF EGGS OF THE RED LOCUST NOMADACRIS SEPTEMFASCIATA (SERV.), AND THE AFRICAN MIGRATORY LOCUST, LOCUSTA MIGRATORIA MIGRATORIODES (R. AND F.), AND ITS INTERRUPTION UNDER PARTICULAR CONDITIONS OF HUMIDITY,
Hebrew Univ., Jerusalem (Israel).
A. S. Shulov.
Anti-Locust Bulletin 48, 1970. 22 p, 21 fig, 12 ref.

Descriptors: *Insect eggs, *Embryonic growth stage, *Incubation, *Humidity, *Drying, *Hatching, *Soil moisture, Water utilization, Insects, Moisture, Inhibition, Eggs, Growth stages, Sands, Moisture availability, Laboratory tests.
Identifiers: *Red Locust, *Africa, *African migratory locust.

The development of embryos of the Red Locust and the African Migratory Locust, investigated by several experiments, was found to be arrested in conditions associated with absence of available moisture. Eggs could not obtain moisture from water vapor even in a saturated atmosphere. It was necessary for soil moisture to come in contact with the eggs in order to be absorbed. Eggs incubated in moist sand developed to hatching without interruption. Embryos in eggs subjected to deposition in dry sand exhibited arrested development until again placed in moist sand. Hatching hoppers from the arrested eggs were smaller than those from non-arrested eggs. There were no significant differences between the two species studied. These studies indicate that moisture availability is an important factor in controlling locust populations. (Yensen-Arizona)
W71-04297

ENVIRONMENTAL CONTROL OF COLORATION IN AN ACRIDID, GASTRIMARGUS AFRICANUS (SAUSSURE),
Makerere Univ., Coll., Kampala (Uganda). Dept. of Zoology.
C. H. Fraser Rowell.
Anti-Locust Bulletin 47, 1970, p 1-48. 27 fig, 11 color plates, 70 ref. Makerere College Research Fund. Grant 259.

Descriptors: *Insects, *Color, *Pigments, *Humidity, *Microenvironment, Growth stages, Inhibition, Biological properties, Drying, Arid lands, Xerophilic animals, Environmental effects, Light intensity, Animal populations, Insect control.
Identifiers: *Locusts, *Africa.

Gastrimargus africanus is one of the desert locusts of arid Africa, causing severe crop damage when in the gregarious stage. The brown forms are gregarious, migratory, and devastating to crops, while the green forms are solitary, less damaging, and non-migratory. Locusts kept in jars with different background colors changed color to resemble all background colors except green. Those placed in jars having green backgrounds did not change color. When the eyes were covered with opaque laquer, only very slight color changes occurred. It was found that by varying humidity and numbers of individuals kept together, the appearance of the green-form adult was slightly inhibited by crowding and drying. The green form was much increased by high humidity, and high humidity with infra-red radiation. Under high humidity adult males produced were 100% green forms. Female nymphs at low humidity produced no green forms. Crowding and high humidity both caused cumulative effects of heavy patterning. These findings have positive implications for insect control in arid African croplands. Eleven color plates illustrate the color forms. (Yensen-Arizona)
W71-04302

INFLUENCE OF MANAGEMENT AND ENVIRONMENTAL FACTORS ON EXTENT OF SOIL WATER DEPLETION BY SPRING WHEAT,
North Dakota State Univ., Fargo. Dept. of Soils.
Armand Bauer, and Ralph A. Young.
North Dakota Agricultural Experiment Station, Research Report 23, January 1969. 13 p, 1 tab, 7 fig, 11 ref.

Descriptors: *Water management (Applied), *Environmental effects, *Soil water, *Water loss, *Wheat, Spring, Period of growth, Drainage effects, Fertility, Fallowing, Rainfall, Wilting point, Moisture availability, Moisture content, Moisture

uptake, Moisture deficit, Soil-water-plant relationships, Storage capacity, Soil texture, Evapotranspiration, Soil environment, Water requirements, Consumptive use, Water storage, Water distribution (Applied), Water demand, Harvesting, Saline soils, Cultivation, North Dakota, Semiarid climates.

Soil-water depletion by crops is an important aspect of water management in arid and semi-arid lands. Water-depletion trials were conducted on well- to moderately-drained soils, medium-to fine-textured, under fallow and non-fallow management at fertility levels from 1958 to 1962 in North Dakota. Spring wheat withdraws water to at least 5 feet from soils without root restrictions. Water is depleted at harvest from soil to 3 feet. Available water remains deeper than 3 feet, if present at seeding. Soil fertility has little effect on depth of water withdrawal. Soil moisture is reduced to less than the permanent-wilting point up to 3-foot depths under some conditions. Available water at seeding remains at harvest sites at greater than 3 feet when growing-season rainfall exceeds 10 inches, or where soil at seeding contains more than 6 inches of water. Water-depletion extent by spring wheat is the same for poor- and well-drained, non-saline and slightly-saline, or non-fallowed and fallowed soils. Seven graphs and a table show effects of soil drainage, growing-season rainfall, stored available soil moisture, and salinity on water-depletion extent. (Popkin-Arizona)
W71-04303

EVALUATION OF IRRIGATION WATER AND NITROGEN FERTILIZER IN CORN PRODUCTION,
Colorado State Univ., Fort Collins. Dept. of Economics; and Colorado State Univ., Fort Collins. Dept. of Agronomy.
Paul C. Huszar, Melvin D. Skold, and R. E. Danielson.
Supported by Bureau of Reclamation. Colorado State University Experiment Station, Technical Bulletin 107, January 1970. 38 p, 7 fig, 24 tab, 29 equations, 6 computer programs, 3 ref.

Descriptors: *Evaluation, *Irrigation water, *Nitrogen, *Fertilizers, *Corn (Field), Crop production, Analytical techniques, Economic prediction, Return (Monetary), Resource allocation, Crop response, Statistical models, Water demand, Farm management, Computer programs, Grains (Crops), Forages, Input-output analysis, Water conservation, Planting management, Equations, On-site data collections, Regression analysis.
Identifiers: Fortran, Partial differential equations, Semi-arid lands.

This study empirically establishes corn production functions for various applications of water and nitrogen fertilizer. This analysis provides data for predicting economic returns and efficient resources allocation. A 5 X 5 incomplete factorial design generated basic yield response involving water and nitrogen fertilizer variables and corn production. Statistical data treatment produced functional relations, shown as estimated water-demand curves, which serve to guide management decisions in arid and semiarid lands. Generated functions for various soils would be beneficial. Six FORTRAN computer programs are presented for calculating corns grains and forage yields for specified water and fertilizer applications and related functions. There are 24 tables of economic input and output data, statistically-developed graphs, and derivations of relevant partial differential equations. (Popkin-Arizona)
W71-04304

RECLAMATION IN THE UNITED STATES,
California State. Dept. of Water Resources, Sacramento.
For primary bibliographic entry see Field 06C.
W71-04306

04. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control of Water on the Surface

1939 RUNOFF INSTRUCTIONS FOR DESIGN OF STORM DRAINS, OFFICE STANDARD NO. 71.
Los Angeles Bureau of Engineering, Calif.
For primary bibliographic entry see Field 08A.
W71-03906

CHARACTERISTICS OF THE CONSTRUCTION OF EQUALLY PROBABLE FLASH FLOOD HYDROGRAPHS,
For primary bibliographic entry see Field 02E.
W71-03976

DETERMINATION OF THE DISTRIBUTION OF RAINFALL FLOODS IN LARGE CATCHMENTS USING HYDROMETEOROLOGICAL DATA,
Meteorological Office, New Delhi (India).
For primary bibliographic entry see Field 02E.
W71-03977

EVALUATION OF MAXIMUM RAINFALL DISCHARGE FROM A REGION OF DEFICIENT RAINFALL DATA,
Dum Dum Airport, Calcutta (India); and Meteorological Office, New Delhi (India).
For primary bibliographic entry see Field 02E.
W71-03978

DETERMINATION OF MAXIMUM FLOOD FLOW AND THE PROBABILITY OF ITS BEING EXCEEDED, USING INCOMPLETE INFORMATION (FRENCH),
Electricite de France, Chatou. Centre de Recherches et d'Essais.
For primary bibliographic entry see Field 02E.
W71-03979

ANALYSIS OF THE RELATION BETWEEN PRECIPITATION AND FLOOD FLOW WITH THE AID OF A TRIPLE TRANSFORMATION BASED ON THE UNIT HYDROGRAPH METHOD (FRENCH),
Transdanubian Water Authority, Szekesehervar (Hungary). Water Management.
For primary bibliographic entry see Field 02A.
W71-03980

EVALUATION OF MAXIMUM FLOW OF FLOODS USING PRECIPITATION DATA (FRENCH),
Grenoble Univ. (France).
For primary bibliographic entry see Field 02A.
W71-03983

ANALYSIS OF FLOOD DURATION (FRENCH),
Transdanubian Water Authority, Szekesfehervar (Hungary). Water Management.
For primary bibliographic entry see Field 02E.
W71-03984

DETERMINATION OF MAXIMUM FLOW AND FLOOD HYDROGRAPHS (FRENCH),
National Office of Irrigation, Rabat (Morocco).
For primary bibliographic entry see Field 02E.
W71-03985

FORMATION OF RAINFALL FLOODS ON SMALL WATERSHEDS. PRINCIPLES OF MAXIMUM STORM RUNOFF COMPUTATION,
Vsesoyuznyi Nauchno—Issledovatelskii Institut Vodosnabzheniya, Kanalizatsii, Gidrotekhnicheskikh Sooruzhenii i Inzhenernoi Gidrogeologii, Moscow (USSR); and Khabarovsk Inst. of Railway Engineers (USSR).
For primary bibliographic entry see Field 02A.
W71-03988

DERIVATION OF A GENERAL FLOOD WAVE HYDROGRAPH FROM A CONTINUOUS WATERSHED WATER BALANCE,
Guelph Univ. (Ontario). School of Agricultural Engineering; and Ceskoslovenska Akademie Ved, Prague. Inst. of Hydrodynamics.
For primary bibliographic entry see Field 02E.
W71-03989

PRACTICAL METHODS OF ESTIMATING MAXIMUM FLOODS (FRENCH),
Consejo Superior di Investigaciones Cientificas, Madrid (Spain). Instituto de Hidrologia.
For primary bibliographic entry see Field 02E.
W71-03990

CALCULATION OF THE MAXIMUM RUNOFF IN FLOODS FROM RAINFALL OVER THE TERRITORIES OF THE UKRAINE AND MOLDAVIA (WITH NO OR INSUFFICIENT HYDROMETRICAL DATA),
Ukrainskii Nauchno-Issledovatelskii Gidrometeorologicheskii Institut, Kiev (USSR).
For primary bibliographic entry see Field 02A.
W71-03991

METHOD OF ESTIMATING STORM RUNOFF FROM SMALL DRAINAGE BASINS,
Zakavkazskii Nauchno-Issledovatelskii Gidrometeorologicheskii Institut, Tiflis (USSR).
For primary bibliographic entry see Field 02E.
W71-03992

SEDIMENT TRANSPORT IN DEGRADING RIVERS,
California Univ., Berkeley. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02J.
W71-03995

INVESTIGATION OF AIRFIELD DRAINAGE ARCTIC AND SUBARCTIC REGIONS, SUPPLEMENT TO PART I, FIELD RECONNAISSANCE AND ANALYSIS,
Minnesota Univ., Minneapolis. St. Anthony Falls Hydraulic Lab.
Loyal A. Johnson.
Available from NTIS as AD-712 427, $3.00 in paper copy, $0.95 in microfiche. Project Report No 18, Jan 1950. 87 p, 9 fig, 52 ref. Army Contract W-21-018-ENG-430.
Identifiers: *Construction, Arctic regions, *Arctic regions, Landing fields, *Landing fields, Drainage, Roads, Freezing, Ice, Rivers, Terrain, Military facilities, Atmospheric precipitation, Erosion, Melting, Avalanches, Hydrology, Thermal properties, Alaska, Photographs, Watersheds, Surface water runoff.

This report summarizes observations that were made during a field trip to Alaska in the spring of 1949. Principal objectives of this phase of the Arctic and Subarctic Airfield Drainage Investigation were (1) to make supplemental on-the-ground observations over a wide range of hydrological phenomena, (2) to note the various forms and effects of icing, (3) to observe springtime runoff from natural watersheds, and (4) to crystallize the findings of activity completed at this time into definite recommendations and point out various aspects where continuation and even expansion of research and study are essential.
W71-04002

MOLE DRAINAGE,
Arctic Construction and Frost Effects Lab., Boston, Mass.
For primary bibliographic entry see Field 08A.
W71-04008

DRAINAGE LINE DEPTH,
Bureau of Reclamation, Denver, Colo.
For primary bibliographic entry see Field 08D.
W71-04016

APPLYING GRADIENT PROJECTION AND CONJUGATE GRADIENT TO THE OPTIMUM OPERATION OF RESERVOIRS,
Kansas State Univ., Manhattan. Dept. of Industrial Engineering.
E. S. Lee, and S. Waziruddin.
Water Resources Bulletin, Vol 6, No 5, p 713-724, September-October 1970. 12 p, 1 fig, 5 tab, 11 ref.

Descriptors: *Optimization, *Multiple-purpose reservoirs, Dynamic programming, Mathematical models.
Identifiers: *Nonlinear programming, Conjugate gradient, Gradient projection algorithm, Quasilinearization.

The recent versions of nonlinear programming techniques such as the conjugate gradient and gradient projection algorithms were used to obtain optimal operating conditions of a multiple reservoirs system with multiple purposes. The algorithms were compared with other techniques in the literature. The conjugate gradient method incorporated the advantage of both the generalized Newton-Raphson, also known as the quasilinearization technique, and the gradient approach while avoiding their major drawbacks. To illustrate the approach a model with three interconnecting reservoirs was considered and was shown schematically. The water was being used for two purposes: irrigation and recreation. The model formulated was dynamic in nature and the seasonal variation of the model was emphasized. A tabular objective function was solved by the two algorithms using several different sets of initial values. The total number of iterations required by the two different algorithms were compared. All the problems converged to the same optimum point. (Kriss-Cornell)
W71-04030

PROCEEDINGS OF A SEMINAR ON RESERVOIR SYSTEMS ANALYSIS, 4-6 NOVEMBER 1969.
Corps of Engineers, Davis, Calif. Hydrologic Engineering Center.

N.d., 161 p, 48 fig, 11 tab, 12 ref.

Descriptors: *Systems analysis, *Reservoir operation, *Operations research, Project planning, Reservoir sites, United States.

The purpose of this seminar was: to provide statements of specific problems in reservoir systems analysis that face the Corps of Engineers; to describe the solution techniques that are currently implemented; and to discuss the potential development of the technology, particularly the applicability of operations research techniques. The specific studies presented included problems dealing with the Kansas River Basin reservoirs, the Kaskaskia River reservoir system, the Apalachicola River, the Roanoke River, the San Francisco reservoir system, the Northeast water supply, the Columbia Basin projects, the Minnesota River Basin, the Arkansas-White-Red Rivers reservoir system, and the Missouri River Main Stem reservoir system. The cast histories and descriptions of problems presented were considered to be representative of the reservoir system problems that exist throughout the country and of the way various projects are being planned and operated. Administrative problems, personality problems and engineering problems were mentioned throughout the seminar. Present methods and future improvements were two of the main topics included in the presentations. (Kriss-Cornell)
W71-04034

AN APPROACH TO FINDING RESERVOIR RULES FOR POWER OPTIMIZATION,
Water Resources Engineers, Inc, Walnut Creek, Calif.
G. K. Young.
Proceedings of the 8th Annual Environmental and Water Resources Engineering Conference, Vanderbilt University, Nashville, Tennessee, June 5-6, 1969, Technical Report no 20, p 87-98. 12 p, 3 fig, 8 ref.

Descriptors: *Dynamic programming, *Optimization, *Power system operations, *Reservoir operations, Economics, Computer programs, Hydroelectric power, Costs, Time, Hydrology.

A forward-looking dynamic program was presented which solved water resource system water allocation over time among systems elements. The computations proceeded forward in time, manipulating economic information, then backtracked through intermediate results to derive optimal physical data. The economic functions were constructed so that dollar values were estimated for every possible distribution of water throughout the system elements. Computer time and memory requirements were given. A hypothetical power optimization was discussed to show the type of problem which was amenable to dynamic programming analysis. Daily flows could be studied over a year's time for a self-contained hydropower system which occasionally purchased outside power to satisfy contractual demands. The approach could be used to identify the costs of constraints. Multiple solutions and the use of penalty functions were suggested means of implementation. Operating rules were inferred by taking the results of dynamic programming calculations, which were optimal system state values over time, and merging the data with given hydrologic data. This data set had hydrologic inflows and other side information matched, time period by time period, with optimal inter-system reservoir releases and transfers. An inference step could be implemented using least squares regression to give the decision rules with reservoir releases as dependent and hydrologic variables as independent variables. (Kriss-Cornell)
W71-04037

1969 RESERVOIR LAND USE SURVEYS: FIELD REPORT AND PROCEDURAL MANUAL,
North Carolina Univ., Chapel Hill. Inst. for Research in Social Science.
Raymond J. Burby.
Research Memorandum, Oct 31, 1969. 10 p, 2 fig, mimeo. OWRR Project B-012-NC (3).

Descriptors: *Reservoir sites, *Land use, *Surveys, *Data collections, Model studies, Aerial photography, Mapping.
Identifiers: *Data coding, Field data.

The procedures utilized to gather land use data in the field, process the data for coding, and coding the data for use in a model developed by the Center for Urban and Regional Studies for reservoir land in various forms of urban and recreational use were described. The three reservoir areas used were Lake Norman in the Charlotte Metropolitan Area,North Carolina; Lake Sidney Lanier in the Atlanta Metropolitan Area; and Lake Boone in the Tri-Cities Metropolitan Area, operated by the TVA. The criteria for recording the extent of land in an urban or recreational use varied with the type of use, i.e., either residential, commercial and industrial, public and institutional, and recreational uses. For field maps of the areas surveyed, aerial photographs and acetate overlays were used. Composite base maps were developed for use in displays and for computing and coding independent variables involving distance measures. A land use classification system was developed to recognize two basic types of land use in reservoir areas: recreation-oriented uses and employment (or urban)-oriented use. The dependent land use data was intended for use in two types of reservoir land development forecast models: (1) a reservoir area model and (2) a shoreline model. (Kriss-Cornell)
W71-04039

A NONLINEAR MULTIPLE RESERVOIR WATER RESOURCES MODEL WITH MULTIPLE PURPOSES,
Kansas State Univ., Manhattan. Dept. of Industrial Engineering.
E. S. Lee, and S. Waziruddin.
In: Modeling and Optimization of Water Resources Systems, Phase I, Kansas State Univ, Appendix B5, (1970). 15 p, 15 fig, 4 ref.

Descriptors: *Optimization, *Simulation analysis, *Multiple-purpose reservoir, Water resources, Dynamic programming, Stochastic processes, Costs, Model studies.
Identifiers: *Nonlinear programming.

In order to test techniques such as simulation, queueing theory, linear and nonlinear programming techniques, and dynamic programming and also to develop more powerful optimization techniques particularly suited for large water resources systems, a water resources model which included all the important characteristics of a complex large water resources system was developed. This model was a multiple reservoir and multiple purpose model. Three different optimization models, namely steady state, dynamic, and stochastic models were presented. A hypothetical reservoir system with four reservoirs and three major tributary systems was used to construct the model. The reservoir was used for five purposes: (1) irrigation, (2) municipal and industrial water supply, (3) hydroelectric power generation, (4) recreation, and (5) flood control. In order to solve the optimization problem, expressions for the various costs and revenues were obtained. Data used to establish the model were from the Jordon Creek area of the Delaware River Basin, the Clearwater River Basin in Idaho and especially the simulation model established by Maass, et al. (See also W71-04043) (Kriss-Cornell)
W71-04044

OPTIMUM OPERATION OF MULTIPLE RESERVOIRS WITH MULTIPLE PURPOSES,
Kansas State Univ., Manhattan. Dept. of Industrial Engineering.
E. S. Lee, and S. Waziruddin.
In: Modeling and Optimization of Water Resources Systems Phase I, Kansas State Univ, Appendix B3, (1970). 20 p, 5 tab, 1 fig, 11 ref.

Descriptors: *Optimization, *Multiple-purpose reservoirs, Dynamic programming, Mathematical models.
Identifiers: Nonlinear programming, Conjugate gradient, Gradient projection algorithm, Quasilinearization.

The recent versions of nonlinear programming techniques such as the conjugate gradient and the gradient projection algorithms were used to obtain the optimal operating conditions of a multiple reservoir system with multiple purposes. These algorithms were compared with other techniques used by various researchers. The conjugate gradient method incorporated the advantages of both the generalized Newton-Raphson, also known as the quasilinearization technique, and the gradient approach while avoiding their major drawbacks. To illustrate the approach a model with three interconnecting reservoirs was considered and was shown schematically. The water was being used for two purposes: irrigation and recreation. The model formulated was dynamic in nature and the seasonal variation of the model was emphasized. A tabular objective function was solved by the two algorithms using several different sets of initial values. The total number of iterations required by the two different algorithms were compared. All the problems converged to the same optimum point. (See also W71-04043) (Kriss-Cornell)

W71-04046

THE DELAWARE RIVER BASIN COMPACT--AN ALTERNATIVE FOR IMPLEMENTING WATER RESOURCES MANAGEMENT (ORGANIZATION, OPERATION, AND RESULTS OF THE BASIN COMPACT),
For primary bibliographic entry see Field 06E.
W71-04089

THE PROPOSED POTOMAC RIVER BASIN COMPACT,
For primary bibliographic entry see Field 06E.
W71-04090

DELAWARE RIVER BASIN COMPACT.
For primary bibliographic entry see Field 06E.
W71-04093

OPTIMUM FIRE POWER OUTPUT FROM A TWO RESERVOIR SYSTEM BY INCREMENTAL DYNAMIC PROGRAMMING,
California Univ., Los Angeles. School of Engineering and Applied Science.
Warren A. Hall, Ricardo C. Harboe, William W. G. Yeh, and Arthur J. Askew.
California University Water Resources Center Contribution No 130, October 1969. 65 p, 5 fig, 20 tab, 4 ref, 4 append. OWRR Proj B-061-CAL (1).

Descriptors: *Reservoir operation, *Water management (Applied), *Optimization, *Dynamic programming, *Computer programs, Probability, Hydrologic budget, Mathematical models, Simulation analysis, Water utilization, Water policy.
Identifiers: Power output optimization.

A model is developed for maximizing the firm power output from a two-reservoir water resources system, with firm water, flood control and the releases for noncommensurate objectives as parameters. State incremental dynamic programming is used as a tool to obtain the optimal operating policy for a given hydrology. In this study, the hydrology used was that defined by the critical period. (See also W70-03836 and W70-05571) (Knapp-USGS)
W71-04111

ENVELOPE-FREQUENCY RELATIONS FOR MAXIMUM FLOODS IN MONSOON AREAS OF THE ECAFE REGION.
Economic Commission for Asia and the Far East (UN), New York.
For primary bibliographic entry see Field 02B.
W71-04117

FLOOD PLAIN INFORMATION, KIRBY CREEK, GRAND PRAIRIE, TEXAS.
Army Engineer District, Fort Worth, Tex.

Corps of Engineers Flood Plain Report, November 1970. 11 p, 5 plate.

Descriptors: *Floods, *Flood damage, *Flood plains, *Texas, Flood control, Flood forecasting, Regional flood, Design flood.

Flooding along Kirby Creek in Texas from the Tarrant-Dallas County line to its mouth is described to aid in solving local flood problems and in planning the best utilization of flood-prone lands. Maps, profiles, cross sections, and test material relating the extent of past flooding to floods which might occur in the future are based on available records of rainfall, runoff, historical flood heights and other technical data. Unit Hydrograph coefficients have been estimated from runoff studies conducted for other watersheds within the Dallas-Fort Worth area. These coefficients, together with rainfall data have been used to compute synthetic runoff hydrographs within the area. The estimated Intermediate Regional Flood and Standard Project Flood discharges at Corn Valley Road are 4,900 and 5,800 cfs, respectively. (Woodard-USGS)

W71-04143

FLOOD PLAIN INFORMATION, TRUCKEE RIVER, RENO-SPARKS-TRUCKEE MEADOWS, NEVADA.
Corps of Engineers, Sacramento, Calif.

Corps of Engineers Flood Plain Report, October 1970. 63 p, 36 fig, 22 plate, 10 tab.

Descriptors: *Floods, *Flood damage, *Flood plains, *Nevada, Regional flood, Flood forecasting, Flood control, Historic flood, Statistical methods.
Identifiers: *Truckee River (Nevada), Standard Project Flood, Intermediate Regional Flood.

Flooding along the Truckee River and several of its tributaries in the Reno-Sparks-Truckee Meadows area, Washoe County, Nevada is described to aid in solving local flood problems and in planning the best utilization of flood-prone lands. Maps, profiles, cross sections, and text material relating the extent of past flooding to floods which might occur in the future are based on available records of rainfall, runoff, historical flood heights and other technical data. The largest flood of record on the Truckee River in the study area occurred on 23 December 1955 with a peak flow of 20,800 cubic feet per second at Reno. That flood caused extensive damage in downtown Reno and in Truckee Meadows. An Intermediate Regional Flood on the Truckee River is one that would have a frequency of occurrence of once in 100 years on the average. Its magnitude was determined from an analysis of streamflow records and computed hydrographs of synthetic floods. These studies show that the peak flow of the Intermediate Regional Flood would be about 18,000 cubic feet per second in Reno. A Standard Project Flood on any of the tributaries in the study area would have peak flows about 20% to 50% larger than the Intermediate Regional Flood. (Woodard-USGS)
W71-04144

FLOOD PLAIN INFORMATION, BURCH CREEK, OGDEN, UTAH.
Corps of Engineers, Sacramento, Calif.

Corps of Engineers Flood Plain Report, November 1970. 31 p, 9 fig, 11 plate, 5 tab.

Descriptors: *Floods, *Flood damage, *Flood plains, *Utah Regional flood, Flood forecasting, Flood control, Statistical methods.
Identifiers: *Burch Creek (Ogden, Utah), Standard project flood, Intermediate regional flood.

Flooding along Burch Creek in the vicinity of Ogden, South Ogden, and Riverdale, Weber County, Utah is described to aid in solving local flood problems and in planning the best utilization of flood-prone lands. Maps, profiles, cross sections, and test material relating the extent of past flooding to floods which might occur in the future are based on available records of rainfall, runoff, historical flood heights and other technical data. Records of floodflows on Burch Creek are non-existent and there are no precipitation stations in the basin. Therefore, basic hydrologic and meteorologic data were developed from records of other stream basins having characteristics similar to those of the Burch Creek basin. These studies show that an Intermediate Regional Flood on Burch Creek would have a peak flow of 1,200 cubic feet per second below Harrison Boulevard and a peak flow of 380 cubic feet per second below Washington Boulevard. A Standard Project Flood would have a peak flow of 1,480 cubic feet per second below Harrison Boulevard and a peak flow of 450 cubic feet per second below Washington Boulevard. (Woodard-USGS)
W71-04145

PREDICTION OF FLOODS FROM HEAVY RAINFALL,
Japan Meteorological Agency, Tokyo. Forecast Section.
For primary bibliographic entry see Field 02E.

W71-04159

THE LOCATION OF LAND USE TYPES: THE NILE VALLEY IN NORTHERN SUDAN,
California Univ., Davis. Dept. of Geography.
David R. Lee.
*Economic Georgraphy, Vol 46, No 1, p 53-62, January 1970. 4 fig, 15 ref.

Descriptors: *Crop production, *Land use, *Regional analysis, *Irrigation systems, *River basins, Economic justification, Social impact, Environmental effects, Rainfall, Floodwater, Flood plains, Flood irrigation, Land resources, Land management, Arid lands, Transportation, Capital, Social values, Social aspects, Dates, Wheat, Pumping, Irrigation practices, Horticulture, Deserts.
Identifiers: *Sudan, *Nile River, *Nomadism, Millet.

A regional land use study was made in the northern Sudan covering a reach of the Nile River from the Sixth Cataract to the village of Abu Hamed, where the Nile begins its great bend southward. Within the study region, 7 types of land utilization were recognized. (1) Settlements-including 600 small villages, primarily local trading centers and 4 larger towns with administrative as well as commercial importance. (2) Horticulture-located mainly in the more southerly regions and consisting mainly of small units growing cash crops for urban markets; irrigation water is lifted from the Nile by counterweighted dipper Persian waterwheel or small, diesel-driven pumps. (3) Major pump schemes-consisting of fairly large pump scheme tenant holdings growing cash crops. (4) Flush cultivation of dura millet with irrigation waters from the Nile during flood stage-a one crop per year agriculture sold locally. (5) Dates and Wheat-the wheat is sown in wet Nile silt after the flood and consumed locally while the date palms are grown on riverbanks and the dates are both consumed locally and sold commercially. (6) Rain cultivation of dura-the only water supply is rainwater and the Nile farmer are discontinuing this practice although it is still the method of grain production throughout the Sudan. (7) Grazed or unused desert-primarily pastoral nomadism. Land is utilized in a particular way throughout this region because of a complex interaction of factors--physical, economic and cultural. (Casey-Arizona)
W71-04228

NEW APPROACHES TO IRRIGATED FARMING IN THE SUDAN: ORGANIZATION AND MANAGEMENT,
Leeds Univ. (England). Dept. of Agricultural Economics.
For primary bibliographic entry see Field 03F.
W71-04231

ECOLOGICAL SIGNIFICANCE OF ALIEN PLANTS IN CALIFORNIA GRASSLANDS,
California State Div. of Forestry, Sacramento.
L. T. Burcham.
Association of American Geographers, Proceedings, Vol 2, p 36-39, 1970. 1 tab, 2 ref.

Descriptors: *California, *Grasslands, *Ecology, *Biological communities, *Water utilization, Grasses, Plant populations, Environmental effects, Mode of operation, Seeds, Germination, Grazing, Agriculture, Habitats, Soil moisture, Productivity, Plant groupings, Nutrients, Geographical regions, Annual succession, Succession vegetation establishment.
Identifiers: *Annual plants, *Perennial plants, *Adaptability, *Alien plants.

Approximately 12 million acres of California now under cultivation or occupied by urban or industrial areas, were originally predominate grasslands. Those remaining grassland areas are generally subjected to intensive grazing and have undergone major alterations. Most striking is the almost complete replacement of native perennial grasses by alien, Mediterranean-type annual plants. This

has occurred in the past century, largely by unintentional seed introduction, and has been characterized by 4 stages of plant succession, the last of which is well established. Mediterranean-type plants are highly adaptive to a wide range of ecological conditions. The significant adaptations facilitating their establishment in California are their ability to grow well under conditions of low temperatures and high soil moisture; quick, effective germination in response to sporadic rains; rapid growth and early maturity; and prolific production of viable seeds. The chronological sequence of dominance corresponds to the descending scale of annual plant succession, indicating a decline in productivity. Further, those plants lower on the annual succession scale germinate faster than those higher up. Conditions for alien grass establishment are usually brought on by overgrazing. Productivity lowering is a decline both in nutrient levels and palatibility. The changes in plant composition have resulted in ecologically significant shifts in biotic relationships of the plant-animal complex. (Casey-Arizona)
W71-04233

HANOVER DRAINAGE AND LEVEE DIST V SANTA FE DRAINAGE AND LEVEE DIST (DRAINAGE DISTRICT'S AUTHORITY TO REMOVE NATURAL BARRIER AND CHANGE DIRECTION OF DRAINAGE FLOW).
For primary bibliographic entry see Field 06E.
W71-04246

FOURWING SALTBUSH CAN BE FIELD PLANTED SUCCESSFULLY,
Forest Service (USDA), Albuquerque, N. Mex. Rocky Mountain Forest and Range Experiment Station.
Earl F. Aldon.
US Forest Serv Res Note RM-173, 1970. 2 p.

Descriptors: *Ranges, Carrying capacity, Land management, *Vegetation establishment, Productivity, *Forages, *Flood plains, *Erosion control, *Soil stability, New Mexico.
Identifiers: Forage production, Ground cover.

Fourwing saltbush, Atriplex canescens (Pursh) Nutt., survived well and grew more than 1 foot during the first year when native seed was grown to 4- to 6-week-old transplants, then transferred to low sites that received some flooding before planting. (Aldon-Forest Service)
W71-04247

WATERSHED MANAGEMENT IN THE UNITED STATES: CONCEPTS AND PRINCIPLES,
Forest Service (USDA), Logan, Utah. Intermountain Forest and Range Experiment Station.
For primary bibliographic entry see Field 03B.
W71-04253

LAW OF SEASHORE, WATERS AND WATERCOURSES OF MAINE AND MASSACHUSETTS,
M. Frankel.
1969. 196 p.

Descriptors: *Massachusetts, *Public rights, *Watercourses (Legal), *Maine, Seashores, Legislation, Governments, Ownership of beds, Legal aspects, Ponds, Rivers, Oceans, Shores, Fishing, Fisheries, Relative rights, Riparian rights, Tidal waters, History, New England, Docks, Boundaries (Property), Estuaries, Bays, Navigation, Navigable waters.

Maine and Massachusetts water law derives from the English common law as modified by the United States Constitution, the colonial ordinances, and subsequent statutes. After discussion of the origin and history of Massachusetts water law, extensive treatment is given property rights in watercourses and the rules governing settlement of boundary disagreements and determination of title to flats and accretions. Navigability of waterways and the legal rights and restrictions resulting from a finding of navigability are explored. The latter portion of the work is devoted to conflicts between state, federal, municipal and private use and control of activities involving watercourses and adjacent property. State regulation predominates, but is restricted by the common law and colonial ordinances. Public and private rights of fishing are discussed in relation to each of the other topics covered. (Dye-Florida)
W71-04257

DO CONTOUR TRENCHES REDUCE WET-MANTLE FLOOD PEAKS,
Forest Service (USDA), Ogden, Utah. Intermountain Forest and Range Experiment Station.
Norbert V. DeByle.
USDA Forest Service Research Note INT-108, 1970. 7 p, illus.

Descriptors: *Peak discharge, *Flood protection, *Flood control, *Small watersheds, *Contour furrows, Contours, Terracing, Infiltration, Ponding, Seepage, Soil engineering, Percolation, Storm runoff, Erosion control, Hydrographs, Rainfall-runoff relationships, Precipitation intensity, Frozen soils, Depression storage, Utah.
Identifiers: *Contour trenches, *Wet-mantle floods, *Sierra Nevada.

A description is given of the January-February flood and associated events that took place on the east side of the Sierra Nevada in 1963, especially those occurrences recorded and observed in a small watershed in the flood-sourc area. Some 110 lineal miles of contour trenches in this 16-square mile watershed may have reduced flow during that flood by about 60 acre feet. (DeByle-Forest Service)
W71-04262

INFILTRATION IN CONTOUR TRENCHES IN THE SIERRA NEVADA,
Forest Service (USDA), Ogden, Utah. Intermountain Forest and Range Experiment Station.
Norbert V. DeByle.
USDA Forest Service Research Note INT-115, 1970. 5 p.

Descriptors: *Contour furrows, *Contours, *Terracing, *Infiltration, *Infiltrometers, Ponding, Seepage, Soil texture, Soil engineering, Hydrologic properties, Percolation, Overland flow, Storm runoff, Erosion control, Flash floods, Floods, Utah.
Identifiers: *Contour trenches, *Double-ring infiltrometers.

Infiltration rates for water ponded in the bottoms of contour trenches constructed in the Sierra Nevada were determined by means of double-ring infiltrometers. The average rate in coarse-textured soils derived from granite was 19.5 inches per hour, more than six times the 3-inch-per-hour rate measured in fine-textured soils derived from andesite. These widely differing rates should be considered when designing a trench network. The probable influence of contrasting infiltration rates on water yields is discussed. (DeByle-Forest Service)
W71-04263

ESTABLISHING AN ENGINEERING BASIS FOR FLOOD PLAIN REGULATIONS,
Tennessee Univ., Knoxville. School of Engineering.
Glenn R. Wall.
M. S. Thesis, University of Tennessee, Distributed by Tennessee Valley Authority, December, 1969. 151 p, 12 fig, 6 tab, 134 ref, 4 append.

Descriptors: *Flood protection, *Flood plain zoning, Decision-making, Methodology, *Tennessee Valley Authority project.
Identifiers: Maximum Probable Flood, Maximum Known Flood, Regional Flood.

Although land use controls are a necessary instrument in flood control planning, the author suggests that engineering information is required in order to substantiate the need for such controls as well as to aid community leaders in decision-making. After a careful analysis of legal cases dealing with the application of land use regulations to the flood plain, the author concludes that these regulations are a legal exercise of the police power. The author outlines a nine step procedure for evaluating the alternative flood control measures, considering such criteria as economics, hydrology, meteorology, agronomy. (Holmes-Rutgers)
W71-04270

USING COMPUTERS TO HELP EVALUATE FLOOD PROTECTION MEASURES,
Economic Research Service, Washington, D.C. Natural Resource Economics Div.; and Oklahoma State Univ. Stillwater. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 07C.
W71-04293

PUBLIC WATER POLICY IN TENNESSEE.
Public Administration Service, Chicago, Ill.
For primary bibliographic entry see Field 06E.
W71-04308

4B. Groundwater Management

OPTIMUM UTILIZATION AND MANAGEMENT OF WATER BEARING FORMATIONS HYDRAULICALLY CONNECTED TO A STRETCH OF THE CONNECTICUT RIVER,
Mass Univ., Amherst. Water Resources Research Center.
Ward S. Motts.
Available from NTIS as PB-197 118, $3.00 in paper copy, $0.95 in microfiche. Project Completion Report, Massachusetts Water Resources Research Center, Amherst, December, 1970. 21 p, 11 ref. OWRR Project A-021-MASS (1).

Descriptors: *Aquifers, Hydrogeology, Groundwater, *Induced infiltration, *Artificial recharge, Recharge, *Groundwater recharge, Subsurface waters, Infiltration, Urbanization, Massachusetts, Conjunctive use.

This investigation examined the groundwater resources and groundwater-recharge potential of the Greater Springfield Complex--a high-density urban area surrounded by a rural peripheral area that will soon undergo urban development. Highly productive gravel and sand aquifers of glacial outwash underlie parts of the peripheral areas, especially west of East Mountain and in the towns of Granby, Hampden and Wilbraham, Mass. Also, a buried channel of outwash yields copious groundwater supplies which are used by the municipality of South Hadley. This buried channel overlain by poorly permeable silt and clay may contain large undeveloped supplies of groundwater in the South Hadley and South Springfield areas. Potential artificial recharge sites occur along areas of glacial outwash in the Greater Springfield Complex. Programs could be developed to recharge surface-water into the aquifers during winter and spring and withdraw the groundwater during the heavy water demand periods of summer and fall. Recharge to wells by induced infiltration is possible along some of the tributaries to the Connecticut River such as the Chicopee River, Scantic River, and Great Brook.
W71-03919

AVAILABILITY OF GROUNDWATER IN WESTERN COWLITZ COUNTY, WASHINGTON,
Geological Survey, Tacoma, Wash.
For primary bibliographic entry see Field 02F.
W71-03934

GROUNDWATER RESOURCES OF COLLINGSWORTH COUNTY, TEXAS,
Geological Survey, Austin, Tex.
For primary bibliographic entry see Field 02F.
W71-03935

GEOLOGY AND GROUNDWATER RESOURCES OF ALLEN COUNTY, KANSAS,
Kansas State Geological Survey, Lawrence.
For primary bibliographic entry see Field 02F.
W71-03937

GROUNDWATER STORAGE CONTROL UNDER INSTITUTIONAL RESTRICTIONS,
Montana State Univ., Bozeman.
Oscar R. Burt.
Water Resources Research, Vol 6, No 6, p 1540-1548, December 1970. 9 p, 1 fig, 11 ref.

Descriptors: *Optimization, *Mathematical models, *Groundwater, Time, Natural recharge, Pricing, Economic efficiency, Institutional constraints.

Optimal allocation of groundwater over time was analyzed for situations in which institutional constraints prevent imposition of a criterion based strictly on economic efficiency. First, an unrestricted optimization of groundwater stocks to maximize present value of production. Natural recharge was a random variable that complicated the decision process. Then, pricing by a central agency under a criterion of economic efficiency was shown to be a theoretically sound approach and a technically feasible one. Next, rationing by forms other than price was dealth with. Water rights expressed as a function of a conditional decision rule X (s) was said to be the best alternative to a direct pricing policy. In defining the temporal allocation model, the length of the discrete time period was left undefined, yet a period of one year or multiples of years was assumed. Another model based on compromise rationing by the central agency dealt with actual physical apportionment. The final model for simplified basin control was a once-and-for-all decision model where the only decision variable was the time in the future at which the basin is rationed to use only net periodic recharge, and until that time groundwater use is uncontrolled. This situation would arise in absence of a central control agency. (Kriss-Cornell)
W71-04024

OPTIMAL OPERATION OF WATER SUPPLY SYSTEMS,
Arizona Univ., Tucson. Hydrology and Water Resources.
George Samuel Clausen.
Technical Report No 1, June 1970. 142 p, 23 fig, 11 tab, 53 ref. OWRR Projects A-010-ARIZ (19) and B-007-ARIZ (5).

Descriptors: *Optimization, *Water supply, *Mathematical models, *Economics, Costs Groundwater, Demand, Arizona.
Identifiers: Tucson Basin.

The traditional water-supply planning problem of economic growth was reviewed in terms of concepts of management science. The various water-supply planning objective functions were all expressions which maximized the difference between gains and losses involved with water development. Maximization was performed using quadratic programming, Lagrangian multiples, and calculus. An objective function used to express the water supply problem in the Tucson Basin, considered gains as cash revenue to a hypothetical central water-control agency which sells water to the uses within the basin. The concept of economic demand was used to estimate the amount of water that municipal, industrial, and agricultural users would purchase at different prices. Linear demand functions were formulated. The possible sources of supply considered were groundwater from within the basin, groundwater from the neighboring Avra Valley Basin, reclaimed waste water and Central Arizona Project water from the Colorado River. Constraints were formulated to allow for limits on water availability for social limits on water prices and for minimal requirements of each user over a specified time period. (Kriss-Cornell)
W71-04042

WATER TABLE DECLINE AND RESULTANT AGRICULTURAL PATTERNS IN THE SALT RIVER VALLEY OF ARIZONA,
Kansas State Coll. of Pittsburg. Dept. of Geography.
For primary bibliographic entry see Field 03F.
W71-04065

GLOSSARY OF TERMS USED IN WELL LOGGING,
Chevron Oil Co., Houston, Tex.
For primary bibliographic entry see Field 10.
W71-04113

EFFECT OF SOLID WASTE DISPOSAL ON GROUNDWATER QUALITY,
California State Dept. of Water Resources, Los Angeles. Southern District.
For primary bibliographic entry see Field 05C.
W71-04116

MOVEMENT OF AGRICULTURAL POLLUTANTS WITH GROUNDWATER,
Geological Survey, Raleigh, N.C.
For primary bibliographic entry see Field 05B.
W71-04121

THE PUMPED WELL,
Colorado Agricultural Experiment Station, Fort Collins.
Robert E. Glover.
Colorado State University Experiment Station, Technical Bulletin 100, September 1968. 23 p, 6 fig, 11 ref.

Descriptors: *Wells, *Pumping, *Water conservation, *Groundwater, *Water management (Applied), Well spacing, Estimating, Evaluation, Withdrawal, Irrigated land, Electric power demand, Water requirements, Water table, Surface-groundwater relationships, Safe yield, Stability, Water supply, Recharge, Storage capacity, Water balance, Transmissivity, Percolation, Drawdown, Consumptive use, Crop production, Precipitation (Atmospheric), Seasonal, Irrigation water, Colorado, Equations.
Identifiers: *Stream depletion, *Intermittent pumping, *Distributed pumping, Arkansas Valley (Colorado), South Platte Valley (Colorado), San Luis Valley (Colorado), Grand Valley (Colorado), High Plains (Colorado).

The charts presented in this bulletin provide a means of estimating the quantitative effect of existing groundwater pumpage and proposed changes in the irrigation areas of Colorado. About 175,295,349 kilowatt hours of electrical power lifted 1,750,000 acre/feet of water in 1966 in Arkansas Valley, South Platte Valley, San Luis Valley, Grand Valley and the High Plains of Colorado. Important questions are the effect of groundwater pumpage on nearby streams and water tables, safe yields, water supply stability, natural and artificial recharge, and storage capacity. Examples of calculating transmissivity, drawdown, stream depletion, intermittent - and distributed-pumping effect, seasonal variations, and sinking-water table are presented. Six graphs and enclosed sketches show drawdown, stream depletion, seasonal variation, and intermittent and distributed pumping. Effects of evaporation, transpiration, and irrigation-water recharge are discussed. Consumptive use and crop demands in terms of precipitation, irrigation supply and percolation loss are considered in order to develop a water budget. (Popkin-Arizona)
W71-04292

ALTERNATIVE CROP ENTERPRISE BUDGETS FOR IRRIGATED PRODUCTION, SOUTHWESTERN OKLAHOMA,
Oklahoma State Univ., Stillwater. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 03F.
W71-04294

4C. Effects on Water of Man's Non-Water Activities

A MULTI-PHASIC COMPONENT STUDY TO PREDICT STORM WATER POLLUTION FROM URBAN AREAS,
Avco Economic Systems Corp., Washington, D.C.
For primary bibliographic entry see Field 05C.
W71-03917

QUALITY OF RUNOFF FROM DIVERSIFIED URBAN WATERSHEDS,
Arizona Univ., Tucson. Dept. of Civil Engineering and Engineering Mechanics.
For primary bibliographic entry see Field 05A.
W71-03929

NATURE'S LAW AND MAN'S ETHIC,
Army Engineer District, Omaha, Nebr. Design Branch.
Jack E. Kepler.
Water Spectrum, Vol 2, No 4, p 35-42, Winter 1970.

Descriptors: *Environmental engineering, *Water resources development, *Ecology, *Multiple-purpose projects, *Optimum development plans, Economics, Fish management, Wildlife management, Recreation, Aesthetics, Habitat improvement, Environment, Revegetation, Dams, Planning, Colorado, Flood control, Wildlife habitats, Natural resources, Air pollution, Water pollution control, Ecosystems, Missouri River, Nebraska, Landscaping.
Identifiers: U. S. Army Corps of Engineers, Boulder Creek (Colorado), South Platte River Valley (Colorado).

The U. S. Army Engineer Omaha District has realized that ecological consequences of engineering works are now a major social concern. The Omaha District is working through coordination of many state and federal agencies to develop a far-reaching environmental resource program. Disciplines included in the program are: ecology, water resources development, architecture and landscaping, zoology, botany, wildlife management, economics, archaeology, urban planning, education, and aesthetics. Total use of all project areas is carefully planned, including air and water pollution control, re-vegetation and other plantings; reservoir water-level management; flood control; promoting growth of natural vegetation; maintaining and/or providing refuges and/or spawning or nesting areas; creating greenbelts; preserving historical and archaeological sites, and increasing or maintaining scenic values. Water resource planning now requires not only technical engineering competence but also an understanding of ecology and an appreciation for environmental values. (Yensen-Arizona)
W71-04069

AN OVERVIEW OF U.S. DEPARTMENT OF INTERIOR'S ROLE IN SEDIMENT CONTROL,
Federal Water Quality Administration, Washington, D.C. Div. of Applied Science and Technology; and Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 04D.
W71-04147

TECHNOLOGY FOR SEDIMENT CONTROL IN URBAN AREAS,
Agricultural Research Service, Washington, D.C. Sedimentation Lab.

For primary bibliographic entry see Field 04D.
W71-04148

THE CONTROL OF EROSION AND SEDIMENT IN HIGHWAY CONSTRUCTION,
Bureau of Public Roads, Washington, D.C.
For primary bibliographic entry see Field 04D.
W71-04149

HYDROGRAPH SYNTHESIS FOR WATERSHED SUBZONES FROM MEASURED URBAN PARAMETERS,
Utah Water Research Lab., Logan.
Joseph B. Evelyn, V. V. Narayana, Riley Dhruva, J. Paul, and Eugene K. Israelsen.
Available from NTIS as PB-197 452, $3.00 in paper copy, $0.95 in microfiche. Completion Report PR WG 74-1, August 1970. 51 p, 10 tab, 35 fig, 17 ref, 3 append. OWRR Project B-025-UTAH (3).

Descriptors: *Simulation analysis, Hydrologic models, *Hydrograph analysis, Watershed studies, Storm drains, *Runoff, Texas, *Model studies, Computer models, *Analog models, Computer programs, Urbanization, Flood forecasting.
Identifiers: Waller Creek, Austin (Texas), *Urban hydrology.

An analog computer program was developed to simulate the outflow hydrographs at four locations within the 38th Street Waller Creek urban watershed at Austin, Texas. Actual outflow was gaged at the final outlet of the watershed. This provided a checkpoint for comparing the simulated and observed final outflow hydrographs. The outflow hydrographs for each subzone were obtained by chronologically abstracting interception, infiltration, and depression storage from their precipitation hyetographs. These outflow hydrographs were then routed through Waller Creek channel to obtain the hydrographs at the four desired locations. The advantages of this model are the flexibility in varying the precipitation inputs to each subzone and the ability to obtain the contribution to the final flood hydrograph of each subzone.
W71-04184

4D. Watershed Protection

THE SAM SIMON WATERSHED: SHRUB CONTROL,
Arizona Univ., Tucson. Coll. of Agriculture.
For primary bibliographic entry see Field 03F.
W71-04058

WATERSHED PROJECTS.
For primary bibliographic entry see Field 06E.
W71-04104

AN OVERVIEW OF U.S. DEPARTMENT OF INTERIOR'S ROLE IN SEDIMENT CONTROL,
Federal Water Quality Administration, Washington, D.C. Div. of Applied Science and Technology; and Geological Survey, Washington, D.C.
Allen Cywin, and Ernest L. Hendricks.
In: Proceedings of National Conference on Sediment Control, September 14-16, 1969, Washington, D C, Environmental Planning Paper, Department of Housing and Urban Development, p 34-40, May 1970. 7 p.

Descriptors: *Sedimentation, *Erosion control, *Sediment control, Water pollution, Turbidity, Sediment transport, Streams, Reservoirs, Reservoir silting, Urbanization, Roads, Construction, Air pollution, Dusts.

Objectives of the following organizations within the USDI having programs related to sediment pollution and its control are reviewed: (1) Federal Water Pollution Control Administration, (2) Geological Survey, (3) Bureau of Reclamation, (4) Bureau of Mines, (5) Bureau of Sport Fisheries and Wildlife, (6) Bureau of Outdoor Recreation, (7) Bureau of Land Management, (8) Office of Water Resources Research, and (9) National Park Service. Sediment represents a heavy economic drain in loss of valuable topsoil. It also makes water unfit for use as municipal and industrial sources of supply unless the water undergoes expensive treatment. It also interferes with navigation, destroys esthetic values and injures aquatic life. As a nutrient carrier, it promotes algal growths which degrade water quality and in turn accelerates the aging process of lakes and reservoirs. Utilization of existing techniques and development of new techniques for sediment control that are tailored specifically for use in urban or urbanizing areas are musts if adequate control of sediment problems is to be achieved and these in turn must consider ecology and water quality requirements. (See also W71-04146) (Woodard-USGS)
W71-04147

TECHNOLOGY FOR SEDIMENT CONTROL IN URBAN AREAS,
Agricultural Research Service, Washington, D.C. Sedimentation Lab.
A. R. Robinson.
In: Proceedings of National Conference on Sediment Control, September 14-16, 1969, Washington, D C, Environmental Planning Paper, Department of Housing and Urban Development, p 48-54, May 1970. 7 p, 4 ref.

Descriptors: *Erosion, *Sediments, *Urbanization, *Erosion control, Construction, Sediment transport, Streams, Planning.
Identifiers: *Erosion control measures.

Under urban construction activity, sediment loads of 25,000 to 140,000 tons per square mile have been measured. Erosion and sediment are usually liabilities, and specific efforts to reduce or manage the adverse effects are required for successful or satisfactory development in use of water and related land resources. Reduction of sediment problems requires information and technology on the mechanics of erosion and sedimentation. The physical and chemical properties of soils also are important factors in the control of erosion. There are needs for new knowledge and methods particularly adapted to the situation where large areas are suddenly changed to urban uses. Generally overlooked is the fact that a flowing stream is a dynamic body which has the energy to transport silt and sediment. Unless flowing in a channel that is nonerodible, such as concrete, the stream will attempt to transport sediment up to its energy ability, and may erode or degrade the bed or surface to obtain this material. If it is carrying a load greater than the available energy, then deposition will occur. Therefore it must be considered to be almost a living, viable body and treated as such. Recommended control measures are presented under the following headings: Permanent vegetation; Diversions; Outlet channels; Bench terraces; Waterway stabilization structures; Bank erosion structures; Stream channel construction; Sediment Basins; and Timing of construction. (See also W71-04146) (Woodard-USGS)
W71-04148

THE CONTROL OF EROSION AND SEDIMENT IN HIGHWAY CONSTRUCTION,
Bureau of Public Roads, Washington, D.C.
Lester A. Herr.
In: Proceedings of National Conference on Sediment Control, September 14-16, 1969, Washington, D C, Environmental Planning Paper, Department of Housing and Urban Development, p 41-47, May 1970. 7 p.

Descriptors: *Erosion, *Sediments, *Erosion control, *Construction, *Highways, Sediment transport, Streams, Planning, Design, Flood damage.
Identifiers: Highway maintenance.

This report emphasizes the importance of prudent planning in highway construction to control erosion and sediment problems that deteriorate our natural resources. Erosion and scour of the banks and beds of streams and rivers are problems both during design and construction of our highways and for years after they are built. Rivers change course and meanders move downstream which make our bridge piers and abutments vulnerable to attack by the main current. In some cases, the initial main river bridge becomes ineffective as a waterway. In such a case expensive revetment or additional openings must be constructed. Channel changes made downstream from our highway structures cause degradation of streambeds which make foundations of existing bridges unsafe and have caused failures. Suggestions for approaching these and other related problems are presented. (See also W71-04146) (Woodard-USGS)
W71-04149

THE EFFECT OF VEGETATION CONVERSION AND FLOOD DISCHARGE ON STREAM CHANNEL GEOMETRY: THE CASE OF SOUTHERN CALIFORNIA WATERSHEDS,
California Univ., Los Angeles.
Antony R. Orme, and Robert G. Bailey.
Association of American Geographers, Proceedings, Vol 2, p 101-106, 1970. 1 fig, 1 ref.

Descriptors: *Chaparral, *Channel flow, *Vegetation effects, *Discharge (Water), *Grassed waterways, Watersheds (Divides), Debris avalanches, Streamflow, Surface drainage, California, Soil moisture, Hydrologic data, On-site investigations, Root systems, Ecology, Ecosystems, Rainfall, Environmental effects, Soil erosion, Precipitation (Atmospheric), Geomorphology, Oak trees, Riparian land, Sediment transport, Sycamore trees, Slope stability, Channel morphology, Canyons, Floods, Sediment load, Energy losses, Storms, Mode of action, Topography, Semiarid climates, Brush control, Land management, Demonstration watersheds.
Identifiers: *Channel form ratio, *Soil slips.

The geometry of a stream channel is a product of many variables. Some are independent, some semidependent and some dependent on the channel itself, but all relate ultimately to the broad environmental parameters of physique, climate and biota. Study of channel geometry adjustment to hydrologic fluctuations may be facilitated by a spectacular environmental responses owing to changing land use and management practices. Monroe and Volfe canyons are neighboring, similar watersheds in the San Dimas Experimental Forest. Both have 15-45 degree hillslopes which periodically contribute choking amounts of debris to the stream channels. Between 1958-1960, 74 ha. of Monroe Canyon sideslopes were converted from chapparral to grass while all of Volfe Canyon was allowed to revert naturally after a fire. During 1958-1963 rainfall was low and Canyon morphologies were unchanged. By contrast, during the stormier 1963-1969 period all areas suffered soil slippage and erosion, but Monroe Canyon lost more than 8 times the debris and sediment from its slopes than Volfe Canyon. The root systems of the native brush are greater soil stabilizers than grass. Cross-sectional surveys of canyon geomorphology established greater changes in Monroe Canyon. This is ascribed, at least in part, to changes in channel stability and stream discharge resulting from riparian vegetation clearing. (Casey-Arizona)
W71-04230

WETTING AGENT FAILS TO CURB EROSION FROM BURNED WATERSHED,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
Raymond M. Rice, and Joseph F. Osborn.
USDA Forest Serv Res Note PSW-219, 1970. 5 p.

Descriptors: *Wettability, *Surfactants, *Forest fires, *Chaparral, *On-site tests, Soil treatment, Rill erosion, Overland flow, Small watersheds, Prototype tests, Erosion control, Brush, Storm runoff, Water quality, California.

Identifiers: Southern California, January 1969 flood, Waternrepellent soil.

A pilot watershed test of the use of a wetting agent to control post-fire erosion showed no effect due to treatment. Further studies are underway to pinpoint the cause of the failure and to develop methods for surmounting it. (Rice-Forest Service)
W71-04250

05. WATER QUALITY MANAGEMENT AND PROTECTION

REVERSE OSMOSIS DESALTING STATE-OF-THE-ART (1969).
Hittman Associates, Inc., Columbia, Md.
For primary bibliographic entry see Field 03A.
W71-04225

5A. Identification of Pollutants

SPECTROPHOTOMETRIC DETERMINATION OF THIOCYANATE AND OXALATE,
Missouri Univ., Columbia. Dept. of Chemistry.
Robert E. Neas.
Ph. D. Thesis, Missouri University, January 1970. 141 p, 25 fig, 20 tab, 54 ref. OWRR Projects B-018-MO (5) and A-014-MO (6).

Descriptors: *Spectrophotometry, *Chemical analysis, *Analytical techniques, *Water analysis, Laboratory tests, Methodology, Evaluation, Instrumentation, Test procedures.
Identifiers: *Thiocyanate, *Oxalate, Uranium.

A new indirect spectrophotometric method for the determination of trace quantities of oxalate utilizes the oxalate interaction with uranium present as the uranium-4- (2-pyridylazo) resorcinol complex. The sensitivity and selectivity of the method compares favorably with existing ones and its operational simplicity is unique among methods for oxalate. A single multicomponent reagent is combined with the sample, the absorbance measured, and the appropriate comparison made with standards or a calibration curve. The continuous variations curves obtained by plotting absorbance diminishment versus mole fraction of oxalate are evidence of the nature of the oxalate-uranium interaction. Precise extrapolations of the curves were possible at both the wavelengths employed, yielding results of 0.47 and 0.45 mole fraction of oxalate, indicating a 1:1 oxalate: Uuranium interaction in each case. (Woodard-USGS)
W71-03928

QUALITY OF RUNOFF FROM DIVERSIFIED URBAN WATERSHEDS,
Arizona Univ., Tucson. Dept. of Civil Engineering and Engineering Mechanics.
Vishnu V. Dharmadhikari.
M Sc Thesis, Arizona University, 1970. 107 p, 4 fig, 33 tab, 21 ref. OWRR Project A-012-ARIZ (1).

Descriptors: *Water quality, *Surface waters, *Runoff, *Hydrologic data, *Data collections, *Arizona, Urbanization, Chemical analysis, Southwest U. S., Chemical properties, Biological properties, Watersheds (Basins), Water pollution sources, Water resources, Chemical oxygen demand.
Identifiers: *Urban hydrology, Experimental watersheds.

Quality-of-water data are presented from analysis of samples collected during the summer and winter rainy seasons of 1969 from three different types of watersheds in Tucson, Arizona. Continuing expansion and intensification of urban and metropolitan development in semiarid regions of the Southwest United States are adding to the problems associated with water supply and management. Urban runoff shows very high values of COD (Chemical Oxygen Demand), even more than that of the secondary sewage treatment plant effluent. In residential and commercial watersheds, this appears to be due to the suspended organic matter. Range of values in such watersheds is from 91 to 347 mg/l. The range observed in runoff from the industrial watershed is considerably higher and wider, 141 to 1693 mg/l. Tests indicate that runoff from domestic or commercial areas can be used for recreational or domestic uses after treatment with alum and adequate chlorination. (Woodard-USGS)
W71-03929

MINE ACID DRAINAGE AND ASSOCIATED FLOW FLUCTUATIONS,
West Virginia Univ., Morgantown. Dept. of Civil Engineering; and New York State Dept. of Conservation, Syracuse. Div. of Water Resources.
For primary bibliographic entry see Field 05B.
W71-03938

QUALITY OF SURFACE WATERS OF THE UNITED STATES, 1965: PARTS 7 AND 8. LOWER MISSISSIPPI RIVER BASIN AND WESTERN GULF OF MEXICO BASINS.
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02K.
W71-04048

STRUCTURE OF WATER IN MICROEMULSIONS: ELECTRICAL, BIREFRINGENCE, AND NUCLEAR MAGNETIC RESONANCE STUDIES,
Florida Univ., Gainesville. Dept. of Chemical Engineering; and Florida Univ., Gainesville. Dept. of Anesthesiology.
For primary bibliographic entry see Field 01B.
W71-04108

ARSENIC IN POTABLE DESERT GROUNDWATER: AN ANALYSIS PROBLEM,
Naval Weapons Center, China Lake, Calif. Michelson Labs.; and Boron Community Services District, Calif.
For primary bibliographic entry see Field 02K.
W71-04109

COST OF PATUXENT RIVER QUALITY MONITORING,
Geological Survey, Arlington, Va.
Jon W. Nauman, and Robert L. Cory.
Journal of American Water Works Association, Vol 62, No 12, p 796-798, December 1970. 3 p, 1 tab, 2 ref.

Descriptors: *Monitoring, *Water quality, *Estuaries, *Water pollution effects, Water temperature, Dissolved oxygen, Electrical conductance, Turbidity, Tides, Water levels, Winds, Instrumentation, Costs.
Identifiers: *Patuxent River (Md).

In October 1963, the USGS installed a continuous water-quality data collection system on the Patuxent River Bridge, near Benedict, Md. The system was instrumented to provide background water quality data for correlation with spot samples taken elsewhere in the estuary and with biological studies carried on in the vicinity of the bridge. Recorded parameters included surface and bottom water temperatures, surface DO, conductivity, turbidity, tide stage, wind speed and wind direction. Total installation and maintenance costs were $22,200. Disregarding installation, the greatest cost was $16,200 or $2,700 annually, for routine maintenance, recalibration, and travel. Overall costs for the collection of water quality data averaged $5,000/yr. The cost was $625 per parameter per year, not including data interpretation and processing. (Knapp-USGS)
W71-04115

A CASE STUDY OF MICROORGANIC CONTAMINANTS IN RIVER WATER,
Mellon Inst., Pittsburgh, Pa.; and Virginia State Water Control Board, Richmond.
Robert A. Baker, and Robert Jennings.
Water and Sewage Works, Vol 117, No 12, p 412-416, December 1970. 5 p, 5 fig, 3 tab, 16 ref.

Descriptors: *Water quality, *Taste, *Odor, *Gas chromatography, *Virginia, Analytical techniques, Organic matter, Solutes, Water pollution effects, Water treatment.
Identifiers: Smith River (Va).

Taste and odor problems in the water of the Smith River, Virginia were studied using gas-liquid chromatography. Phenol is not present in the raw water. The fine red precipitate found in these waters, including the plant mixing basin, suggests an alternate mechanism for organic contaminant transport other than as dissolved solute. The particulates may serve as condensation nuclei for organic materials. Changes in river flow rate alter the scouring velocity for critically-sized particles. These solids then carry along organic materials which in that particular volume occur at concentrations in excess of their discharge or formation rates. (Knapp-USGS)
W71-04119

STUDY OF MOLYBDENUM IN PUBLIC WATER SUPPLY,
Denver Board of Water Commissioners, Colo.
Clair G. Farnsworth.
Water and Sewage Works, Vol 117, No 12, p 418-421, December 1970. 4 p, 1 map, 2 tab, 16 ref.

Descriptors: *Water pollution sources, *Water pollution effects, *Molybdenum, *Colorado, Toxicity, Public health, Water treatment, Water quality.
Identifiers: *Denver (Colo).

Denver, Colorado uses a water supply with a molybdenum content of over 15 micrograms per liter. While molybdenum is much less toxic in general than other metals, such as arsenic, selenium, chromium, and lead, it is suggested that suitable protection should be taken to insure against any large amount of a water-soluble compound of molybdenum entering public water systems. There have been no reports of toxicity due to this molybdenum content of drinking water. Intake of molybdenum is about 0.00003% of average body weight, well within presently accepted tolerable limits. (Knapp-USGS)
W71-04120

ISOTOPE HYDROLOGY, 1970.
International Atomic Energy Agency, Vienna (Austria).
For primary bibliographic entry see Field 02A.
W71-04133

CATALOG OF INFORMATION ON WATER DATA, EDITION 1970 - INDEX TO WATER QUALITY SECTION.
Geological Survey, Washington, D.C. Office of Water Data Coordination.
For primary bibliographic entry see Field 07C.
W71-04150

THE BACKGROUND CONCENTRATIONS OF COPPER, LEAD, AND ZINC IN STREAMS OF THE 'NEW LEAD BELT', MISSOURI,
Missouri Univ., Rolla. Dept. of Geology.
Nicholas Howard Tibbs.
M Sc Thesis, Missouri University at Rolla, 1969. 77 p, 19 fig, 1 plate, 3 tab, 38 ref, 6 append. OWRR Project B-021-MO (1).

Descriptors: *Water quality, *Water analysis, *Surface waters, *Water pollution sources, Water chemistry, *Missouri, Streams, Chemical analysis, Spectroscopy, Copper, Natural streams, Geochemistry, Data collections, Geology, Mining.

Identifiers: *New Lead Belt (Missouri), Lead, Zinc.

The New Lead Belt of southeast Missouri, predicted to be one of the largest lead deposits in the world, extends from just west of Ellington, on a due north line to Viburnum. At present this area is one of sparse population and relative wilderness, with rugged hills and swift, crystal-clear streams. It was anticipated that the lead mining activity will stimulate a sharp increase in industrial activity in the future in this area. Here then was a potential 'before-after' study in pollution. It was presumed that this intense mining activity could cause significant contamination in the stream waters by the heavy metals- notably copper, lead, and zinc, the primary ore metals. Analytical methods for these metals were developed for atomic absorption spectroscopy. The data obtained from these analyses were arranged in histograms and critically analyzed. The background concentrations were established to be 4-6 ppb (parts per billion) for all three elements. Methods are presented for identifying both short term and long term contamination by using the data distributions. The data distributions were not useful for geochemical prospecting under the geological conditions studied. (Woodard-USGS)
W71-04182

REARING DEVICES FOR STREAM INSECT LARVAE,
Federal Water Pollution Control Administration, Cincinnati, Ohio. Analytical Quality Control Lab.
For primary bibliographic entry see Field 07B.
W71-04190

ARTIFICIAL SUBSTRATE SAMPLING, MACROINVERTEBRATES IN A POLLUTED REACH OF THE KLAMATH RIVER, OREGON,
Federal Water Quality Administration, Cincinnati, Ohio. Analytical Quality Control Lab.
William T. Mason, Jr., J. B. Anderson, R. Douglas Kreis, and William C. Johnson.
Journal Water Pollution Control Federation, Vol 42, No 8, Part 2, p R315-R328, August 1970. 6 fig, 4 tab, 7 ref.

Descriptors: *Water quality, *Bioindicators, *Municipal wastes, *Water pollution, Dissolved oxygen, Hydrogen ion concentration, Water temperature, Return flow, Midges, Mayflies, Caddisflies, Dragonflies, Oligochaetes, Clams, Snails, Larvae, Sampling, Nutrients, Farm wastes, Water pollution effects, Path of pollutants, Oregon.
Identifiers: *Klamath River, Lost River, Damsel flies, Leeches, Beetles, Moths, Scud, Sowbugs, Flatworms, Bryozoa, Hydras, Sponges, Artificial substrates.

In 1964 the Federal Water Quality Administration (FWQA) initiated the Klamath basin study to determine the effects on water quality of agricultural wastes in irrigation return water on the Klamath and Lost Rivers. As part of the study, macroinvertebrates were collected at monthly intervals to determine the effects of irrigation return water and pollution from the city of Klamath Falls on the aquatic life. During 1965 and 1966, artificial substrates were installed at five locations in a 30 mile reach of the Klamath River, Oregon. The samples were collected on artificial substrates held in wire baskets which were suspended not more than 48 inches or less than 18 inches below the water surface. The organisms collected were divided into two categories, pollution associated and facultative. The macroinvertebrates collected at various locations and for different times of the year are enumerated in tables. In addition, the percentage of facultative and pollution associated organisms at the various sampling stations are shown. The water temperature, dissolved oxygen, and pH at the various locations is also given. The number of macroinvertebrates collected in the Klamath River during the summer of 1965 and 1966 ranged from a minimum of 44 collected in September 1965 to a maximum of 7,120 collected in July 1965. 84 taxa representing 15 orders were identified from samples collected each month at each station during 1965. The most prevalent organisms in the samples during 1965 and 1966 were those which are found in marginal zones of pollution: Chironomid larvae, oligochaetes, amphipods, isopods, odonates, leeches, and gastropods. (Little-Battelle)
W71-04191

EVALUATION REPORT 1: AUTOMATIC BEAKER SAMPLE CHANGER,
Federal Water Pollution Control Administration, Cincinnati, Ohio. Analytical Quality Control Lab.
For primary bibliographic entry see Field 07B.
W71-04192

A NEW FRESHWATER CENTRIC DIATOM MICROSIPHONA POTAMOS GEN. ET SP. NOV.,
Federal Water Pollution Control Administration, Cincinnati, Ohio. Analytical Quality Control Lab.
For primary bibliographic entry see Field 05C.
W71-04193

METHODS OF COLLECTION AND ANALYSIS OF PLANKTON AND PERIPHYTON SAMPLES IN THE WATER POLLUTION SURVEILLANCE SYSTEM,
Federal Water Quality Administration, Cincinnati, Ohio. Analytical Quality Control Lab.
Cornelius I. Weber.
Available from: EPA, WQO, Analytical Quality Control Laboratory, 1014 Broadway, Cincinnati, Ohio 45202. June 1970 (Repringt). 27 p, 9 fig.

Descriptors: *Sampling, *Periphyton, *Analytical techniques, *Zooplankton, Phytoplankton, Rotifers, Crustaceans, Rivers, Lakes.
Identifiers: *FWQA methods, Sample preservation.

This report, which was first published in July 1966, discusses methods of collection, preservation, and analysis of plankton and periphyton found in lakes and rivers. All aspects of the analytical methods are discussed in detail including types of sample bottles and shipping containers, types of equipment used for the analysis, preservation and preparation of samples, and labeling of samples. (Little-Battelle)
W71-04195

ELIMINATION OF 'MEMORY' PEAKS ENCOUNTERED IN AQUEOUS-INJECTION GAS CHROMATOGRAPHY,
Federal Water Pollution Control Administration, Cincinnati, Ohio. Analytical Quality Control Lab.
For primary bibliographic entry see Field 07B.
W71-04196

LABORATORY GUIDE FOR THE IDENTIFICATION ON PETROLEUM PRODUCTS,
Federal Water Pollution Control Administration, Cincinnati, Ohio. Analytical Quality Control Lab.
Fred K. Kawahara.
Available from: EPA, WQO, Analytical Quality Control Laboratory, 1014 Broadway, Cincinnati, Ohio 45202. January 1969. 41 p, 7 tab, 25 ref.

Descriptors: *Oil, *Sampling, *Gas chromatography, *Spectroscopy, Preservation, Solubility, Gravimetric analysis, Separation techniques, Distillation, Viscosity, Trace elements, Fresh water, Sea water, Gasoline, Asphalt, Oily water.
Identifiers: *FWQA methods, Chemical extraction, Doctor test, Infrared spectroscopy, Molecular weight, Melting point, Crude oil, Naphtha, Jet fuel, Kerosene, Paraffin wax, White oil, Cutting oil, Gas oil, Motor oil, Fuel oil, Grease.

This laboratory guide for the identification of petroleum pollutants has been prepared to provide the analyst with specific methods leading to a positive characterization of petroleum waste materials. Discussions cover: (1) sampling, which includes collection, preservation of samples, sample preparation for analysis, and concentration; (2) preliminary solubility studies; (3) separation, analyses, and characterization by determination of API gravity, by use of the Doctor test, by determination of sulfur, distillation ranges, molecular weight (by the Rast method), melting point, and viscosity; and (4) identification by means of gas chromatography, infrared analyses, and trace constituent analyses. The report includes numerous tables of data. (Little-Battelle)
W71-04199

FWPCA METHOD STUDY 1: MINERAL AND PHYSICAL ANALYSES - AN EVALUATION OF FWPCA ANALYTICAL METHODS FOR SURFACE WATERS,
Federal Water Pollution Control Administration, Cincinnati, Ohio. Analytical Quality Control Lab.
J. A. Winter, and M. R. Midgett.
Available from: EPA WQO, Analytical Quality Control Laboratory, 1014 Broadway, Cincinnati, Ohio 45202. June 1969. 33 p, 9 fig, 2 tab, 7 ref.

Descriptors: *Reliability, *Test procedures, *Water analysis, *Chemical analysis, Hydrogen ion concentration, Electrical conductance, Dissolved solids, Hardness (Water), Sodium, Potassium, Acidity, Alkalinity, Chlorides, Sulfates, Laboratory tests, Mathematical studies, Statistical methods.
Identifiers: *FWQA methods.

In order to validate the analytical methods employed by FWPCA, synthetic water samples were prepared in three ranges of concentration for determination of pH, specific conductants, total dissolved solids, total hardness, sodium, potassium, total acidity/alkalinity, chloride, and sulfate. The analyses were conducted by 51 analysts from 20 laboratories in FWPCA and five non-FWPCA laboratories. The results of the analyses were treated statistically to determine the accuracy and adequacy of the method employed. Detailed results of the analyses and of the statistical treatments are given in tables and graphs. (Little-Battelle)
W71-04200

PESTICIDES IN SURFACE WATERS OF THE UNITED STATES: A FIVE-YEAR SUMMARY 1964-1968,
Federal Water Pollution Control Administration, Cincinnati, Ohio. Analytical Quality Control Lab.
James J. Lichtenberg, James W. Eichelberger, Ronald C. Dressman, and James E. Longbottom.
Available from: EPA WQO, Analytical Quality Control Laboratory, 1014 Broadway, Cincinnati, Ohio 45202. September 1969. 34 p, 2 fig, 8 tab, 10 ref.

Descriptors: *Waste water (Pollution), *Dieldrin, *Organophosphorus pesticides, Hudson River, *Pesticide residues, Endrin, DDT, Aldrin, Heptachlor, Water quality, Fishkill, Delaware River, Tennessee River, Ohio River, St. Lawrence River, Lake Erie, Lake Michigan, Lake Superior, Mississippi River, Missouri River, Rio Grande River, Colorado River, Columbia River, Water pollution sources.
Identifiers: *Chemical recovery, *Parathion, Lindane, BHC, Chlodrane, Methyl, Parathion, Fenthion, Ethion, Malathion, Trithion, DDE, DDD, Heptachlor epoxide, Connecticut River, Schuylkill River, Merrimack River, Raritan River, Potomac River, Shenandoah River, Susquehanna River, Roanoke River, Neuse River, Apalachicola River, Beauclair River, Escambia River, Oklahoma River, West Palm Beach Canal, Chattahoochee River, Savannah River, Clinch River, Tombigbee River, Allegheny River, Kanawha River, Monongahela River, Wabash River, Detroit River, St. Clair River, St. Mary's River, Saginaw River, Maumee River, Illinois River, Fox River, North Platte River, Platte River, South Platte River, Yellowstone River, Rainy River, Red River, Kansas River, Big Horn River, Atchafalaya River, Arkansas River, Brazos River, Verdigris River, Trinity River, Bear River, Green River, Klamath River, Sacramento River, San Joaquin River, San Juan River, Truckee River, Clearwater River, Pend

Oreille River, Snake River, Spokane River, Willamette River, Yakima River, Carbamate compounds.

This report summarizes the results of five annual synoptic surveys (1964-1968) for chlorinated hydrocarbon pesticides in surface water of the United States. The analytical methods employed were based upon standard methods established by FWQA which are specific for dieldrin, endrin, DDT, DDE, DDD, aldrin, heptachlor, heptachlor expoxide, lindane, BHC, gamma-chlordane and technical chlordane. In the 1967 and 1968 surveys, samples were also analyzed for methyl parathion, parathion, fenthion, ethion, malathion, and trithion. The results showed wide-spread occurrence of the pesticides throughout the United States. The number of occurrences reached a peak in 1966 and then declined sharply in 1967 and 1968. The maximum concentrations have not exceeded permissible limits as they relate to human intake directly from a domestic water supply. However, they have often exceeded the environmental limit recommended by the Federal Committee on Water Quality Criteria. Maps and tables are included to show the distribution of the various pesticides throughout the United States. (Little-Battelle)
W71-04201

FWPCA METHODS FOR CHEMICAL ANALSIS OF WATER AND WASTES.
Federal Water Pollution Control Administration, Cincinnati, Ohio. Analytical Quality Control Lab.

Available from: EPA WQO, Analytical Quality Control Laboratory, 1014 Broadway, Cincinnati, Ohio 45202. November 1969. 280 p, 21 fig, 4 tab, 32 ref.

Descriptors: *Chemical analyses, *Waste water (Pollution), *Fresh water, *Saline water, *Laboratory techniques, Acidity, Alkalinity, Aluminum, Arsenic compounds, Biochemical oxygen demand, Calcium, Chemical oxygen demand, Chlorides, Chromium, Color, Copper, Dissolved oxygen, Fluorides, Hardness (Water), Iron, Magnesium, Manganese, Nitrogen, Nitrates, Nitrites, Oil, Hydrogen ion concentration, Phosphorus, Potassium, Silica, Sodium, Solid wastes, Electrical conductance, Sulfates, Sulfides, Water temperature, Odor, Turbidity, Colorimetry, Organic compounds.
Identifiers: *FWQA methods, Cadmium, Cyanide, Lead, MBAS, Grease, Organic carbon, Organic nitrogen, Phenolics, Orthophosphate, Selenium, Zinc, Sample preservation, Chlorine demand, Chlorine residual.

This manual describes the procedures for analysis of water selected by a team of senior scientists within FWPCA based on the criteria that: (1) the methods should meet FWPCA needs, (2) they would utilize the equipment and skills normally available, (3) the methods are valid, and (4) they are sufficiently rapid to permit routine analysis of large numbers of samples. In most cases the methods are satisfactory for the measurement of the indicated constituents in both water and waste waters and in both saline and fresh water samples. Most of the procedures included will ultimately appear in Standard Methods for Examination of Water and Waste Water, 13th Edition, and/or ASTM Standards, Part 23. (Little-Battelle)
W71-04202

METHOD SELECTION STUDY 1: A COMPARISON OF THREE MODIFICATIONS OF THE SINGLE REAGENT METHOD FOR SOLUBLE ORTHOPHOSPHATE,
Federal Water Pollution Control Administration, Cincinnati, Ohio. Analytical Quality Control Lab.
John A. Winter, and Robert L. Booth.
Available from: EPA WQO, Analytical Quality Control Laboratory, 1014 Broadway, Cincinnati, Ohio 45202. April 1969. 40 p, 5 fig, 11 tab, 5 ref.

Descriptors: *Phosphates, *Water analysis, Fresh water, Sea water, Sewage effluents, Surface water, Statistical methods, Iron.
Identifiers: *Orthophosphates, *Chemical recovery, *FWQA methods, Distilled water, Chemical interference.

A round-robin test was conducted by the Analytical Quality Control (AQC) Laboratory on three modifications of the mixed reagent method of analysis for soluble orthophosphate for the purpose of establishing an FWPCA interim official method. The tests were conducted on spiked distilled water samples, spiked and unspiked river water, spiked and unspiked sea water, and, in one case, sewage effluent. Based on the data, which are included in graphs and tables, the method of Murphy and Riley gave the best precision and accuracy and the least bias and therefore was selected as the FWPCA interim official method. (Little-Battelle)
W71-04204

ANALYTICAL INSTRUMENTS IN WATER POLLUTION CONTROL,
Federal Water Pollution Control Administration, Cincinnati, Ohio. Analytical Quality Control Lab.
Dwight G. Ballinger.
Analysis Instrumentation, Vol 7, p 242-246, May 1969. 10 ref.

Descriptors: *Laboratory equipment, *Chemical analysis, *Automation, *Instrumentation, Gas chromatography, Spectrophotometry, Volumetric analysis.
Identifiers: Atomic absorption spectrophotometer, Infrared spectrophotometer, Total carbon analyzer, Ion meters, Auto analyzer, Automatic titrators.

The application of various types of instruments to water analysis is reviewed. The instruments reviewed are the gas chromatograph which is used for the determination of trace organic contaminants including pesticides and herbicides, the atomic absorption spectrophotometer which is used for determination of metals in water, total carbon analyzers which are used for determining organic carbon content of water samples, ion meters which are used for determination of cyanide, fluoride, nitrate, chloride, sulfide, calcium and dissolved oxygen, and the infrared spectrophotometer which is used for identification of organic pollutants. Consideration is also given to the Technicon AutoAnayzer and automatic titrators which have contributed to the automation and speedup of routine analyses. Further improvements in instrumentation are needed to extend the parameters that are covered and to further reduce the amount of manual labor involved in analyzing samples. (Little-Battelle)
W71-04205

PERIPHYTON BIOMASS-CHLOROPHYLL RATIO AS AN INDEX OF WATER QUALITY,
Federal Water Pollution Control Administration, Cincinnati, Ohio. Analytical Quality Control Lab.
Cornelius I. Weber, and Ben H. McFarland.
Available from: EPA WQO, Analytical Quality Control Laboratory, 1014 Broadway, Cincinnati, Ohio 45202. March 1969. 19 p, 8 tab, 20 ref.

Descriptors: *Water quality, *Bioindicators, *Chlorophyll, *Ohio River, *Analytical techniques, Biomass, Water pollution, Algae, Periphyton, Phosphorus, Hydrogen ion concentration, Alkalinity, Hardness (Water), Chlorides, Organic matter, Carbon, Water pollution effects, Bacteria, Periphyton, Ohio.
Identifiers: *Autotrophic Index, Chlorophyll a, Shayler Run, Organic carbon, Cincinnati (Ohio).

A review was made of the literature regarding the relationship of biomass and chlorophyll as a first step in determining the potential use of the biomass-chlorophyll ratio as an index of water quality. Laboratory studies were then begun in 1967 on samples taken at two stations above and below the major waste outfall in the Ohio River at Cincinnati. In 1968, samples taken by the FWPCA Newtown Fish Toxicology Laboratory from a small creek (Shayler Run) were included in the study. Since chlorophyll a is the only form of chlorophyll found in all algae, the biomass-chlorophyll which is termed the autotrophic index should be based exclusively on this pigment. The Autotrophic Indices for the samples taken at the two Ohio River stations were significantly different. The data obtained at the upstream station were similar to those from Shayler Run, and indicated a predominantly autotrophic periphyton. In contrast to the upstream station, the high indices at the station below the waste outfall suggested a 'consumer-type' community. The Autotrophic Index shows considerable promise as a tool in water quality studies. Data on water chemistry, Autotrophic Indices, composition of periphyton, and test methods are included. (Little-Battelle)
W71-04206

THE PRESERVATION OF PHYTOPLANKTON GRAB SAMPLES,
Federal Water Pollution Control Administration, Cincinnati, Ohio.
Cornelius I. Weber.
Transactions of the American Microscopical Society, Vol 87, No 1, p 70-81, 1968. 8 fig, 2 tab, 24 ref.

Descriptors: *Photoplankton, *Algicides, *Bactericides, Scenedesmus, Bioassay, Analytical techniques.
Identifiers: *Formalin, *Sample preservation, *Mercuric chloride, *Merthiolate, Cyclotella meneghiniana, Iodine.

The bactericidal and algicidal properties of formalin, mercuric chloride, and Merthiolate were tested using grab riverwater samples and cultures of Scenedesmus bijuga and Cyclotella meneghiniana. Formalin was bactericidal in grab samples at a concentration of 1.0%, and arrested algal growth at a concentration of 0.01% to 0.1%. Mercuric chloride was bactericidal and algicidal at 13-27 mg per liter. Merthiolate arrested algal growth at 1 mg per liter when accompanied by an equal concentration of iodine. Although not bactericidal at concentrations as high as 1 gm per liter, Merthiolate when used in combination with iodine satisfactorily stabilized algal counts in stored samples and was superior to formalin and mercuric chloride in preserving the morphology and color of the algae. The effects of formalin, mercuric chloride, and Merthiolate on bacterial count and algal growth rate are presented. (McCann-Battelle)
W71-04207

PHYTOPLANKTON, SESTON, AND DISSOLVED ORGANIC CARBON IN THE LITTLE MIAMI RIVER AT CINCINNATI, OHIO,
Federal Water Pollution Control Administration, Cincinnati, Ohio.
Cornelius I. Weber, and Donald R. Moore.
Limnology and Oceanography, Vol 12, No 2, p 311-318, April 1967. 6 fig, 22 ref.

Descriptors: *Phytoplankton, *Seston, *Diatoms, Carbon, Organic matter, Bioindicators, Water quality, Water temperature, Ohio.
Identifiers: *Organic carbon, Little Miami River, Cyclotella, Melosira, Stephanodiscus, Cincinnati (Ohio).

A yearlong study was made of the phytoplankton, seston, and dissolved organic carbon in a small, hardwater, midwestern stream. The annual cycle of cell counts and volumes followed the cycle in water temperature. The dominant algae were small, euplanktonic, centric diatoms of the genera Cyclotella, Melosira, and Stephanodiscus, which contributed an average of 63% of the cell count and 66% of the cell volume. The seston averaged 15.8% organic matter by ignition. Stream flow and particulate organic matter were positively correlated from December to April, negatively from

May to November. The photoplankton contributed an average of 38% of the particulate organic matter from May to November. The dissolved organic carbon averaged 6.4 mg/liter, and showed no seasonal cycle. (McCann-Battelle)
W71-04209

A DIRECT-READING SPECTROCHEMICAL PROCEDURE FOR THE MEASUREMENT OF NINETEEN MINOR ELEMENTS IN NATURAL WATER,
Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio. Water Pollution Surveillance System.
John F. Kopp, and Robert C. Kroner.
Applied Spectroscopy, Vol 19, No 5, p 155-159, 1965. 6 tab, 12 ref.

Descriptors: *Trace elements, Spectroscopy, Aluminum, *Arsenic compounds, Boron, Cobalt, Chromium, Copper, Iron, Molybdenum, Manganese, Missouri River, Ohio River, Mississippi River, Water analysis.
Identifiers: *Spectrochemical analysis, Silver, Barium, Beryllium, Cadmium, Nickel, Platinum, *Lead, Strontium, Vanadium, Zinc.

A method employing a direct reading spectrochemical procedure for the quantitative determination of 19 minor elements in water is presented. Silver, aluminum, arsenic, boron, barium, beryllium, cadmium, cobalt, chromium, copper, iron, molybdenum, manganese, nickel, platinum, lead, strontium, vanadium, and zinc are determined in concentrated water samples by the rotating disc-high-voltage spark technique. Using background as the internal standard, concentrations in the order of 0.01 to 100 mg/l in the processed samples are determined in a matter of minutes by converting the 'counts' from a sequential read-out system on a drum calculator. Recoveries of the elements from known solutions varied from 80 to 113 percent at the 90 percent confidence level. Six tables provide detailed data on the 19 trace elements. (McCann-Battelle)
W71-04211

GAS CHROMATOGRAPHIC SEPARATIONS OF MIXED CHLORINATED FUNGICIDES,
California Univ., Davis. Dept. of Environmental Toxicology.
Wendell W. Kilgore, and Earl R. White.
Journal of Chromatographic Science, Vol 8, p 166-168, March 1970. 4 fig, 9 ref.

Descriptors: *Chromatography, *Fungicides, *Chlorinated hydrocarbon pesticides, 2-4-5-T, Analytical methods.
Identifiers: Ionization detector, Botran, Chemagro 2635, Dyrene, HCB, Lanstan, PCNB, PCP, Phygon, Spergon, TCNB, TCP, 2,4,6-T, Methylation.

This study was undertaken to develop a technique suitable for the separation and detection of a mixture of fungicides on a single gas-liquid chromatography (GC) column. The chemicals were detected either as the parent structures or as their methyl ethers. The analyses were performed with: (1) An all-glass isothermal system utilizing an electron capture detector, and (2) An all-metal temperature program system utilizing a flame ionization detector. The results clearly demonstrate that mixtures of chlorinated fungicides (parent structures or derivatives) can be separated by GC as readily as most insecticides and herbicides. Chromatograms are included to show the separation of chlorinated fungicides. (McCann-Battelle)
W71-04213

THE ELECTRON CAPTURE DETECTOR IN THE ANALYSIS OF CHLORINATED HYDROCARBON PESTICIDES IN TISSUES WITH AND WITHOUT CLEAN-UP,
Miami Univ., Coral Gables, Fla. Dept. of Pharmacology.
J. L. Radomski, and Alberto Rey.
Journal of Chromatographic Science, Vol 8, p 108-114, March 1970. 7 fig, 4 tab, 6 ref.

Descriptors: *Chromatography, *Dieldrin, *Lipids, DDT, Heptachlor, Aldrin, Heptachlor epoxide, Gonads, Separation techniques, Analytical methods, Chlorinated hydrocarbon pesticides.
Identifiers: *Sensitivity, *Electron capture detector, DDD, DDE, Lindane, HCH, Blood, Brain, Liver, Kidney, Clean-up, Gas chromatography, Thin layer chromatography.

The procedures are described for the rapid analysis of chlorinated hydrocarbon pesticides in human and animal tissues utilizing the high temperature electron capture detector. The nickel 63 'hidden window' electron capture detector gives superior sensitivity to chlorinated hydrocarbons and is highly stable toward the response losses experienced with other detectors when biological samples are analyzed. The detector is best operated in the pulse mode at 60v, 3 microsec on and 270 microsec off, at 355C, utilizing prepurified nitrogen as carrier gas. Good linearity and high sensitivity are observed. Fat and blood of both humans and animals is optimally analyzed by chromatography of the hydrocarbon extract without the use of clean-up. The analysis of brain, liver, kidney, and gonadal tissue is best carried out utilizing a TLC clean-up step which readily removes the interferences present. Very high sensitivities are obtained using these methods. (McCann-Battelle)
W71-04214

MICRODETERMINATION OF DERIVATIVES OF PHENOLS AND MERCAPTANS BY MEANS OF ELECTRON CAPTURE GAS CHROMATOGRAPHY,
Federal Water Pollution Control Administration, Cincinnati, Ohio. Div. of Pollution Surveillance.
Fred K. Kawahara.
Analytical Chemistry, Vol 40, No 6, p 1009-1010, May 1968. 1 fig, 3 tab, 9 ref.

Descriptors: *Phenols, *Gas chromatography, *Ethers, Analytical methods, Industrial wastes, Ethers, Aldrin.
Identifiers: *Mercaptans, *Electron capture gas chromatography, Thioethers.

Traces of mercaptans and phenols adversely affect the palatability of water. Sensitive and rapid methods are needed for measuring these compounds which constitute a small portion of the complex weak acid fraction. However, a large portion of the weak acid fractions, isolated from the organic materials extracted from river water, is neither phenolic nor mercaptan. Several interesting approaches have been investigated to develop either faster or selective techniques of analysis. A highly selective method is required because of the numerous contaminants in the weak acid fraction. The conversion of phenol and mercaptan to a derivative which can exhibit electron capture response seemed to offer unique advantages for their measurement. Ethers and thioethers, derived from phenols and mercaptans, respectively, with alpha-bromo-2,3,4,5,6-pentafluorotoluene exhibit excellent electron capture response. This property accounts for excellent measurements in the presence of impurities. Only phenols, mercaptans, and acids will react rapidly with the fluoro-organic reagent under the described conditions. Derivatives of phenols and mercaptans are stable in water and are amenable to gas-liquid chromatographic separations. (McCann-Battelle)
W71-04218

A LIMESTONE-FILLED, ARTIFICIAL SUBSTRATE SAMPLER-FLOAT UNIT FOR COLLECTING MACROINVERTEBRATES IN LARGE STREAMS,
Federal Water Pollution Control Administration, Cincinnati, Ohio.
For primary bibliographic entry see Field 07B.
W71-04219

5B. Sources of Pollution

THE INCIDENCE AND FORMATION OF MINE DRAINAGE POLLUTION - APPENDIX C TO 'REPORT FOR DEVELOPMENT OF WATER RESOURCES OF APPALACHIA'.
Corps of Engineers, Cincinnati, Ohio. Office of Appalachian Studies.

Corps of Engineers, Office of Appalachian Studies Report, Vol 18 of 25 Vol, Appendix C, June 1969. 45 p, 10 fig, 2 plate, 1 tab, 22 ref.

Descriptors: *Acid mine water, *Water pollution sources, *Water pollution control, *Water chemistry, *Appalachian Mountain Region, Water resources development, Oxidation, Pyrite, Sulfides, Iron compounds, Iron bacteria, Sulfur bacteria, Planning.
Identifiers: Appalachian redevelopment.

Appendix C is one of nine appendices to the 25-volume series, 'Report for development of water resources in Appalachia,' and furnishes information on mine drainage pollution. Effluent from coal mines is the major source of water pollution in most of the Appalachian region. Pollution results from mineral acidity created when pyritic material, exposed during mining, is oxidized and the products are dissolved and carried into streams and lakes. The acid waters are very corrosive to metal and damage concrete structures; the low pH is harmful to aquatic life, reducing or eliminating fish and otherwise lowering an area's recreational potential. This appendix and its five report attachments discuss chemical complexities in formation of acid mine drainage, identify its extent and intensity, and present measures to correct or better control the problem. Attachment A, an atlas of drainage incidence compiled by FWPCA, is a summary reference. Attachment B is an annotated bibliography of pertinent literature extant in 1967. Attachments C and D briefly analyze factors that contribute to formation of mine pollution. Attachment E surveys control costs for acid mine drainage using various techniques. (See also W71-03873 thru W71-03877) (Lang-USGS)
W71-03872

STREAM POLLUTION BY COAL MINE DRAINAGE IN APPALACHIA.
Federal Water Quality Administration, Cincinnati, Ohio.

Attachment A to Appendix C-The Incidence and Formation of Mine Drainage Pollution, Federal Water Pollution Control Administration Report, Vol 18 of 25 Vol on Development of Water Resources in Appalachia, 1967, (Rev 1969). 261 p, 62 fig, 28 tab, 43 ref.

Descriptors: *Acid mine water, *Water pollution sources, *Water pollution control, *Mine drainage, *Water chemistry, *Appalachian Mountain Region, Data collections, Oxidation, Pyrite, Iron compounds, Stream improvement, Planning.
Identifiers: Appalachian redevelopment, Coal mine drainage.

Coal mine drainage pollution is documented for 18 stream basins and the Anthracite area of northeastern Pennsylvania. Coal deposits underlie more than 72,000 sq mi of Appalachia, about 40% of the total area. Effluent from mining is major source of water pollution in most of the Appalachian region. About 10,500 mi of streams are significantly affected by mine drainage pollution, 6,700 mi of these on a continuous basis. The Monongahela, Allegheny, and Susquehanna-Delaware River basins of Pennsylvania, West Virginia, and Maryland contain about 68% of the mine drainage acidity in Appalachia, and 43% of the affected miles of streams are in these watersheds. Inactive underground mines contribute 52% of the acid, active underground mines 19%, inactive surface mines 11%,

and active surface mines 1%. Refuse piles and coal processing plants also contribute. In some places most of the pollution in a watershed comes from a few sources. While changes have occurred in mine drainage pollution loads (historically), substantial increases have not occurred within the past 25 yr. Water quality data are given in 30 tables. The potential for further pollution from mining is reflected by the fact that recoverable reserves of bituminous coals in Appalachia are equal to 440 times the 1964 production and seven times the total cumulative production from the start of mining to 1965. (See also W71-03872) (Lang-USGS)
W71-03873

A REVIEW OF CURRENT RESEARCH ON COAL MINE DRAINAGE IN APPALACHIA,
Bureau of Mines, Pittsburgh, Pa. Area 1 Mineral Resources Office.
Robert W. Stephan, and Walter C. Lorenz.
Attachment B to Appendix C - The Incidence and Formation of Mine Drainage Pollution, Bureau of Mines Report, Vol 18 of 25 Vol on Development of Water Resources in Appalachia, 1967. 26 p, 14 ref.

Descriptors: *Acid mine water, *Water pollution sources, *Water pollution control, *Reviews, *Bibliographies, Water chemistry, Oxidation, Pyrite, Iron compounds, Iron bacteria, Sulfur bacteria.
Identifiers: *Appalachian redevelopment.

The status of current research methods for abatement or control of acid mine drainage is reviewed. Evaluation is made of present day technology for control of the drainage waters. In 1962 about 3.2 million tons of sulfuric acid was being discharged annually into streams from active and abandoned coal mining operations in Appalachia. Such pollution degrades the value of the streams for domestic and industrial water use as well as for recreation. Mine refuse piles and other operations also produce acid waters. Work is described for four demonstration projects - one near Elkins, W. Va. and three in Pa. - in which mine sealing, direct iron removal, ozone oxidation, impoundment oxidation, demineralization, flash distillation, and reverse osmosis are methods being tried. Deep well injection of mine waters offers limited possibilities for permanent disposal. A literature review of research is presented in an annotated bibliography. (See also W71-03872) (Lang-USGS)
W71-03874

FACTORS THAT AFFECT THE FORMATION OF COAL MINE DRAINAGE POLLUTION IN APPALACHIA,
Bureau of Mines, Pittsburgh, Pa. Area 1 Mineral Resource Office.
Walter C. Lorenz, and Robert W. Stephan.
Attachment C to Appendix C - The Incidence and Formation of Mine Drainage Pollution, Bureau of Mines Report, Vol 18 of 25 Vol on Development of Water Resources in Appalachia, 1967. 17 p, 53 ref.

Descriptors: *Acid mine water, *Water pollution sources, *Water pollution control, *Reviews, *Bibliographies, Water chemistry, Oxidation, Pyrite, Iron compounds, Iron bacteria, Sulfur bacteria.
Identifiers: *Appalachian redevelopment.

Coal mine drainage pollutes more than 5,000 miles of streams and 13,000 acres of ponds in Appalachia. Pyrite formed contemporaneously with the formation of coal; it is associated with coal, and in rocks adjacent to the coal. It is oxidized in the presence of oxygen and moisture, and the oxidation products when dissolved in water are stream pollutants. Current research on pyrite oxidation includes studies of electrochemical reactions, and the effects of iron-oxidizing bacteria on this oxidation. (See also W71-03872) (Knapp-USGS)
W71-03875

THE OXIDATION OF PYRITE ASSOCIATED WITH COAL MINES,
Bureau of Mines, Pittsburgh, Pa. Area 1 Mineral Resource Office.
Walter C. Lorenz, and Robert W. Stephen.
Attachment D to Appendix C - The Incidence and Formation of Mine Drainage Pollution, Bureau of Mines Report, Vol 18 of 25 Vol on Development of Water Resources in Appalachia, 1967. 21 p, 100 ref.

Descriptors: *Acid mine water, *Water pollution sources, *Water pollution control, *Reviews, *Bibliographies, Water chemistry, Oxidation, Pyrite, Iron compounds, Iron bacteria, Sulfur bacteria.
Identifiers: *Appalachian redevelopment.

A survey of the literature and current research on the oxidation of pyrite, both chemical and bacterial, is presented to indicate progress in this field. Pyrite oxidizes when it is an anode. Oxidizing potential for pyrite has been described as being between 560 and 860 millivolts. Factors affecting the rates of pyrite oxidation are oxygen concentration, particle size, temperature, moisture, pH (hydrogen-ion concentration) and Eh (electrode potential) of the reaction, and a possible catalyst. Postulated characteristics of the oxidation reaction are based upon chemisorption of oxygen, high oxidation potential, and bacterial catalyst. Iron- and sulfur-oxidizing bacteria increase the rate of oxidation of pyrite. These bacteria oxidize the ferrous ion to the ferric state. Among the promising lines of research are studies of the electrochemical properties, the effects of bacteria, and surface treatment of pyrite. (See also W71-03872) (Knapp-USGS)
W71-03876

SURVEY OF COSTS ON METHODS FOR CONTROL OF ACID MINE DRAINAGE POLLUTION,
Bureau of Mines, Pittsburgh, Pa. Area 1 Mineral Resource Office.
Robert W. Stephan, and Walter C. Lorenz.
Attachment E to Appendix C - The Incidence and Formation of Mine Drainage Pollution, Bureau of Mines Report, Vol 18 of 25 Vol on Development of Water Resources in Appalachia, 1967. 35 p, 8 fig, 21 tab, 21 ref.

Descriptors: *Cost analysis, *Water pollution control, *Appalachian Mountain Region, *Acid mine water, Neutralization, Waste water disposal, Injection wells, Water treatment, Ion exchange, Chemical precipitation.
Identifiers: *Appalachian redevelopment.

This report presents capital investment and operating costs on the various processes and methods available for the abatement of pollution due to acid coal mine water drainage. The abatement measures include neutralization, iron removal, demineralization, and physical disposal by deep well injection. Cost data are presented on the reclamation of land disturbed by surface and strip mining operations. A summary of available data relating the various size plants for treating acid mine water is reported for the various processes for abatement of pollution. The costs of pollution abatement measures as determined in this survey range from less than $0.07/1,000 gal. to $1.13/1,000 gal. of acid mine water treated. (See also W71-03872) (Knapp-USGS)
W71-03877

ECORSE RIVER WATER QUALITY STUDY, MAY-JULY, 1969.
Michigan Water Resources Commission, Lansing. Dept. of Natural Resources.

Department of Natural Resources, August 1969. 41 p, 12 fig, 9 tab, 2 ref.

Descriptors: *Impaired water quality, *Pollutant identification, *Surveys, *Water pollution sources, Benthos, Sludge worms, Biochemical oxygen demand, Cyandphyta, Domestic wastes, On-site data collections, Michigan.
Identifiers: *Combined sewer overflows, *Ecorse River.

A survey was initiated in May 1969 to evaluate the present water quality of the Ecorse River and relate existing conditions to cause. The Ecorse River Basin is located in a densely populated portion of southeastern Michigan. Its natural drainage area of 46 square miles is located entirely in Wayne County and includes portions of the southern Detroit metropolitan area. The North Branch and the South Branch join to form the main stream three-fourths of a mile west of the Detroit River. The studies confirmed that the lower Ecorse River system is in a severely degraded condition. The principal factors causing degradation are storm water overflows which originiate from combined sewer systems. High biochemical oxygen demand of the Benthic sludge, combined with the BOD of suspended materials and algal respiration, caused extermely low dissolved oxygen levels during the survey. The largest source of the BOD is the Benthic sludge and thus represents a continuous drain on the stream's oxygen resources. Biological studies of the plankton community revealed excessive algal densities, 93 percent of which were bluegreens. Benthic samples from the lower reaches contained only pollution tolerant sludgeworms, indicating an environment in an extreme state of degradation. (Poertner)
W71-03907

MINE ACID DRAINAGE AND ASSOCIATED FLOW FLUCTUATIONS,
West Virginia Univ., Morgantown. Dept. of Civil Engineering; and New York State Dept. of Conservation, Syracuse. Div. of Water Resources.
Charles R. Jenkins, and Henry C. Carroll.
In: Proceedings of the West Virginia Academy of Science, 1969, 44th Annual Session held at West Liberty State College, West Virginia, Apr 10-12, 1968, Vol 41, p 286-293, May 1970. 8 p, 9 fig, 1 tab, 5 ref.

Descriptors: *Acid mine water, *West Virginia, *Water pollution sources, Mine drainage, Water analysis, Water quality, Stream gages, Water chemistry, Weirs, Mine acids, Mine wastes, Streamflow, Water yield.
Identifiers: Acid mine drainage.

The Left Fork of Little Sandy Creek basin, between Fellowsville and Tunnelton, West Virginia, was surveyed for the location of mine drainage sources. At least 30 out of a total of 47 potential sources of drainage were found to produce acid at some time during the year. Thin-crested 90 deg weirs installed along with permanent staffs were found to be sufficiently accurate for measuring flow fluctuation from the mines. A flow meter was used in determining the relationship between acid load and flow from a mine. Tests were also run for pH, alkalinity, hardness, sulfates, iron, and aluminum. The acid load or production was found to be directly proportional to flow. Sulfates, iron, and aluminum were found to vary much the same as acidity. Hardness was not closely associated to acidity concentration but generally was reduced at higher flow due to a dilution effect. The pH remained relatively constant and independent of flow. A summation of conditions from individual mines was found to account closely with conditions observed in the receiving stream. (Knapp-USGS)
W71-03938

MOVEMENT OF ALGAL- AND FUNGAL-BOUND RADIOSTRONTUM AS CHELATE COMPLEXES IN A CALCAREOUS SOIL,
Arizona Univ., Tucson.
Wallace H. Fuller, and Michael F. L'Annunziata.
Atomic Energy Commission Contract AT (11-1)-947. Soil Science, Vol 107, No 3, March 1969, p 223-230. 3 tab, 5 fig, 7 ref.

Descriptors: *Chelation, *Strontium radioisotopes, *Algae, *Fungi, *Calcareous soil, Soil water, Soil water movement, Leaching, Arid lands, Depth, Cyanophyta, Chlorophyta, Sierozems, Soil microbiology, Distribution patterns, Soil profiles.
Identifiers: *Radiostrontium, *Algal-bound radiostrontium, *Fungal-bound radiostrontium, *Microbial activity, *Radiostrontium complexes, DTPA, Soil water profile.

This report evaluates the effect of microbial activity on movement of algal- and fungal-bound raiostrontium, the effect of DTPA on Sr super 89 mobility adsorbed by algal and fungal cells in a calcareous soil, and extra-cellular algal excretions as Sr super 89 complexing agents. Leaching with a water-formaldehyde and water solution caused little Sr super 89-bound movement by Aspergillus niger (fungi), Rhisopus arrhizus (fungi), Oscillatoria bijuga (blue-green alga) and Chlorococcum sp. (a green alga) in Mohave sandy loam. Leaching with 0.067 M DTPA solution displaced from 0.2 to 1.6 percent of the algal- and fungal-bound Sr super 89 below a 20-cm soil depth. The Sr super 89 profile distribution remaining in the leached soil contrasted with the DTPA-treated and the water-treated soil columns. Wherever DTPA was added Sr super 89 moved downward, whereas in the water-treated control Sr super 89 remained in the upper 2.5 cm. Negatively charged Sr super 89 complexes formed from excretions of the desert soil alga Anacystis menegh are shown. Tables indicate Sr super 89 movement with respect to algal and fungal tissue, biologically bound Sr super 89 from DTPA treatment and total extractable Sr super 89. Figures are included of exchangeable and fixed Sr super 89 with soil depth for various biological soil treatments, and evidence of Sr super 89 in a cell-free Anacystis medium as negative complexes. (Popkin-Arizona)
W71-04067

EFFECT OF SOLID WASTE DISPOSAL ON GROUNDWATER QUALITY,
California State Dept. of Water Resources, Los Angeles. Southern District.
For primary bibliographic entry see Field 05C.
W71-04116

MOVEMENT OF AGRICULTURAL POLLUTANTS WITH GROUNDWATER,
Geological Survey, Raleigh, N.C.
Harry E. LeGrand.
In: Agricultural Practices and Water Quality, Iowa State University Press, Ames, 1970, p 303-313. 2 fig, 18 ref.

Descriptors: *Path of pollutants, *Farm wastes, *Water pollution sources, *Groundwater, *Agricultural chemicals, Fertilizers, Pesticides, Nutrients, Soil water, Soils, Seepage, Soil chemistry, Absorption, Soil mechanics, Water quality, Soil properties, Water wells, Water table, Environmental effects, Water chemistry, Infiltration.
Identifiers: *Agricultural pollutants.

The volume of groundwater polluted by plant nutrients, animal wastes, and pesticides appears to be small. Numerous small polluted zones of water occur in the upper part of the zone of saturation. Sufficient safeguards are available to minimize groundwater pollution to the extent that good agricultural practices should not be deterred. The unsaturated zone above the water table attenuates almost all of the foreign bodies that are potential pollutants of the underlying groundwater. Chemical fertilizers, animal wastes, and pesticides vary greatly in their tendency to degrade in ground environments. The following favorable environmental factors tend to reduce the changes of pollution of water from wells and springs: (1) A deep water table, which (a) allows for sorption of pollutants on earth materials, (b) slows subsurface movement of pollutants, and (c) facilitates oxidation or other beneficial 'die-away' effects. (2) Sufficient clay in the path of pollutants so that retention or sorption of pollutants is favorable. (3) A gradient of the water table beneath a waste site away from nearby wells. (4) A great distance between wells and wastes. (Woodard-USGS)
W71-04121

DISTRIBUTION OF HYDROGEN ISOTOPES IN CANADIAN WATERS,
Atomic Energy of Canada Ltd., Chalk River (Ontario). Chalk River Nuclear Labs.
For primary bibliographic entry see Field 02A.
W71-04134

VARIATION OF THE TRITIUM AND OXYGEN-18 CONTENT IN PRECIPITATION AND SNOW-PACK IN A REPRESENTATIVE BASIN IN CZECHOSLOVAKIA,
International Atomic Energy Agency, Vienna (Austria); and Hydraulic Research Inst., Prague (Czechoslovakia).
For primary bibliographic entry see Field 02A.
W71-04135

ARTIFICIAL SUBSTRATE SAMPLING, MACROINVERTEBRATES IN A POLLUTED REACH OF THE KLAMATH RIVER, OREGON,
Federal Water Quality Administration, Cincinnati, Ohio. Analytical Quality Control Lab.
For primary bibliographic entry see Field 05A.
W71-04191

USE OF A FLOATING PERIPHYTON SAMPLER FOR WATER POLLUTION SURVEILLANCE,
Federal Water Pollution Control Administration, Cincinnati, Ohio. Analytical Quality Control Lab.
Cornelius I. Weber, and Ronald L. Raschke.
Available from: EPA, WQO, Analytical Quality Control Laboratory, 1014 Broadway, Cincinnati, Ohio 45202. February 1970 (Reprint). 22 p, 4 fig, 5 tab, 24 ref.

Descriptors: *Water quality, *Bioindicators, *Sampling, *Periphyton, Analytical techniques, Diatoms, Phytoplankton, Water pollution effects, Ohio River, Klamath River, Monitoring.
Identifiers: *Artificial substrates, *FWQA methods.

This report is a reprint of a report first published in September 1966. A description is given of a floating sampler that was used to collect periphyton in the Ohio River at Cincinnati. The rate of colonization of glass slides by diatoms was determined, and the periphyton and plankton diatom communities were compared. The periphyton diatoms were dominated by species of nitzschia and navicula, whereas the plankton diatoms consisted largely of species of melosira and cyclotella. Glass slides were also exposed above and below a group of polluted outfalls on the upper Klamath River, Oregon to show how the number of diatoms present served as indicators of water quality. The sampler is shown schematically, and the data regarding the number of periphyton and plankton present in the Ohio and Klamath Rivers, as well as the species, are included in figures and tables. (Little-Battelle)
W71-04194

PESTICIDES IN SURFACE WATERS OF THE UNITED STATES: A FIVE-YEAR SUMMARY 1964-1968,
Federal Water Pollution Control Administration, Cincinnati, Ohio. Analytical Quality Control Lab.
For primary bibliographic entry see Field 05A.
W71-04201

ACCUMULATION OF PHOSPHATES IN WATER,
Agricultural Research Service, Morris, Minn. North Central Soil Conservation Research Center.
Robert F. Holt, Donald R. Timmons, and Joseph J. Latterell.
Journal of Agriculture and Food Chemistry, Vol 18, No 5, p 781-784, 1970. 1 tab, 37 ref.

Descriptors: *Phosphates, *Path of pollutants, *Eutrophication, *Leaching nutrients, Fertilizers, Precipitation (Atmospheric), Runoff, Animal wastes, Surface waters, Soil erosion, Nutrients, Algae, Lake Superior, Water Pollution sources, Minnesota, Washington, Connecticut.
Identifiers: Illinois River, St. Louis River, Black River (Minnesota), Lake Washington (Washington), Linsley Pond (Connecticut), Lake Zoar (Connecticut), Lake Minnetonka (Minnesota), Big Stone Lake (Minnesota), Lake Crystal (Minnesota).

Natural and agricultural sources of phosphorus to surface waters include percipitation, animal wastes, fertilizers, and land runoff. The actual contribution from these sources is shown to be quite low. However, the concentration of phosphorus required to support profuse algal blooms is so low that the limited amounts supplied are sufficient to exceed this requirement. Eroded soil delivers appreciable amounts of phosphorus to surface waters, but the soil materials capacity to sorb phosphorus results in little tendency for release of this source into the water. Bottom sediments appear to be a sink for dissolved orthophosphate that is supplied to surface waters. Leaching of vegetation can supply relatively large amounts of phosphorus to lakes and streams. Deep incorporation of phosphatic fertilizers materially reduces the concentration of phosphorus in runoff waters as compared to shallow incorporation. Phosphorus concentrations in several lakes and streams are shown. (McCann-Battelle)
W71-04216

5C. Effects of Pollution

ACTION OF IRON SALTS IN SOLUTION ON GOLDFISH,
Bureau of Sport Fisheries and Wildlife, Cook, Washington. Western Fish Nutrition Lab.
Laurence M. Ashley.
The Progressive Fish-Culturist, Vol 32, No 2, 1970. 109 p.

Descriptors: Laboratory equipment, Fish physiology, Water pollution effects, *Iron compounds, *Chlorides, *Sulfates, Juvenile fishes.
Identifiers: *Goldfish, Carassius auratus.

Goldfish (Carassius auratus) weighing 13-28 gm. were exposed to ferrous or ferric chlorides or sulfates dissolved in distilled water. Salt content ranged from 5-100 milligrams per liter. Iron salts were most harmful immediately after they were in solution. Gill blockage was most severe at this time, but was reversible. Fish responded similarly to exposure to the four iron salts tested. (Wahtola-Washington)
W71-03851

STUDY OF WATER POLLUTION PROBLEMS WHICH AFFECT FISH AND OTHER AQUATIC FORMS,
Wyoming Game and Fish Research Lab., Laramie.
Douglas L. Mitchum, and Tom D. Moore.
Final Job Completion Report, Research Project Segment, Project No FW-3-R-13, 1966. 32 p, 12 ref, 12 tab, 10 fig.

Descriptors: *Water pollution effects, *Fish, *Mine wastes, Trout, *Aquatic life, *Invertebrates, Toxicity, Periphyton, Plankton, Benthos.
Identifiers: Radiation, *Uranium.

The extent and effect were studied of pollution by uranium mine effluent on fish and other aquatic organisms in the Medicine Bow River and contributing streams. Samples of water, bottom mud, plankton, benthic organisms and aquatic plants were collected. Fish samples were collected only in July. The naturally occurring levels of uranium, in streams included in this study were determined to be about 5 ppb. Uranium concentrations at the various stations affected by the mine effluent ranged between 2,000 ppb and 60 ppb. Data in-

dicated that these relatively high uranium levels may be toxic to trout. The mine effluent did not appear to have any apparent adverse affect on plankton, periphyton, bottom fauna organisms, and fish species other than trout. Accumulated radiation could not be detected in bones of the fish specimens collected from the various stations. Findings show that uranium mine pollution existed in the Medicine Bow River drainage area and a potentially serious pollution problem existed downstream from the study area. (Wahtola-Washington)
W71-03852

A CHAMBER FOR OFFERING ALTERNATIVE CONDITIONS TO SMALL MOTILE AQUATIC ANIMALS,
Stockholm Univ. (Sweden). Asko Lab.
Bjorn Ganning, and Fredrik Wulff.
Ophelia, Vol 3, p 151-160, 1966. 5 fig, 7 ref.

Descriptors: *Laboratory equipment, Copepods, *Aquatic animals, Aquatic microorganisms, Crustaceans, Daphnia, Temperature, Salinity.
Identifiers: Nitocra spinipes, Daphnia magna, Phyllopods.

A preference chamber especially adapted for use with small free-living aquatic animals is described. In a small open plexiglass chamber with water inlets in the ends and a common outlet in the middle the experimental animals are offered alternative test solutions. The test solutions are kept at a constant water level 2-3 mm above the bottom, and a sharp and well defined gradient is established in the middle of the chamber. During experiments it is possible to observe very small animals with a stereomicroscope. Temperature, salinity and oxygen preference tests have been carried out. Small rockpool crustaceans were offered different test solutions and they have so far always very clearly shown preference for one of the alternatives. (Wahtola-Washington)
W71-03853

THE EFFECT OF SOME SOLVENTS ON LOWER WATER ANIMALS AND ON FISHES,
Vyzkumny Ustav Rybarsky a Hydrobiologicky Vodnany, Prague (Czechoslovakia).
J. Havelka, and O. Albertova.
Buletin VUR Vodnany, Vol 2, p 11-15, 1970. 2 ref.

Descriptors: *Water pollution effects, *Solvents, *Aquatic animals, *Fishes, Temperature, Laboratory equipment, Daphnia, Worms, Toxicity.
Identifiers: Propyleneglyco, Cyclohexanon, Methylcyclohexanon, CCl4, *Daphnia magna, *Tubifex tubifex, *Lebistes reticulatus.

Results of the determination of harmless, harmful and lethal concentrations of eleven technical solvents, used in the technological production processes in chemical plants, on water fleas (Daphnia magna), pink worms (Tubifex tubifex), and Lebistes reticulatus. The values obtained were derived from trials under laboratory conditions. As diluent, stabilized tap-water was used. In the practical use of the results described, when the effect of sewage water on the quality of natural waters is determined, lower concentrations should be chosen with a view to the physical and chemical properties of the recipient subject to study. Due to the difficult chemical identification and determination of solvents in sewage waters and contaminated recipients, the most unfailing demonstration of their harmfullness to water fauna are toxicological tests of sewage and polluted natural waters. (Wahtola-Washington)
W71-03854

ECORSE RIVER WATER QUALITY STUDY, MAY-JULY, 1969.
Michigan Water Resources Commission, Lansing Dept. of Natural Resources.
For primary bibliographic entry see Field 05B.
W71-03907

A MULTI-PHASIC COMPONENT STUDY TO PREDICT STORM WATER POLLUTION FROM URBAN AREAS,
Avco Economic Systems Corp., Washington, D.C.
Jerry C. Cleveland, Ralph H. Ramsey, Paul R. Walters, and Gary L. Miessler.
Available from NTIS as PB-197 169, $3.00 in paper copy, $0.95 in microfiche. Completion Report, 1970. 248 p, 71 tab, 20 fig, 40 ref, 4 append. OWRR Project C-1743 (No. 3164) (1).

Descriptors: *Storm water runoff, *Water pollution control, *Water quality control, *Mathematical models, *Analytical technique, Runoff forecasting, Land use, Soil contamination, Rain water, Erosion control, Watershed management, Environmental sanitation, *Urbanization, Municipal wastes.
Identifiers: Storm water pollution prediction, Urban storm water pollution, Storm water abatement analysis, *Storm water pollution control, Land activity pollution, Urban hydrology, Water pollution analysis, Structural pollution abatement measures, Non-structural abatement management.

The purpose of this study is to provide a procedure to enable prediction of storm water pollution from land activity, precipitation and runoff in an urban areas. The procedures presented in this study will enable the city planner and civil engineer to predict quantitative and qualitative pollution loads resulting from surface storm water runoff to a receiving stream. The study presents ten mathematical models for this purpose and evaluates them by application to several selected demonstration cities. Also presented are criteria for pollution control strategies and for assessment of various structural and non-structural control measures, their general effectiveness and costs. Guidelines are discussed for the use of these procedures and development of an optimal water pollution control plan. The study concludes that: (1) storm water pollution prediction models are feasible but of limited application unless adequate data are available on hydrological, precipitation and runoff characteristics, as well as land activity detail for representative metropolitan areas, and (2) storm water pollution control for most effectiveness should relate to the specific characteristics of an urban area. Maximum economies will derive from pollution abatement measures taken during the early stages of area development.
W71-03917

THE ROLE OF AQUATIC VASCULAR PLANTS IN THE EUTROPHICATION OF SELECTED LAKES IN WASTERN MASSACHUSETTS,
Massachusetts Univ., Amherst. Water Resources Research Center.
P. A. Bentley, and R. B. Livingston.
Available from NTIS as PB-197 115, $3.00 in paper copy, $0.95 in microfiche. Massachusetts Water Resources Research Center, Publication No 11 (1970). 80 p, 6 tab, 31 fig, 9 ref. OWRR Project A-023-MASS (1).

Descriptors: *Eutrophication, Alkalinity, Conductivity, Massachusetts, Lakes, *Aquatic plants, Nutrients, *Trophic level, Plant growth, Water pollution effects.
Identifiers: Plant distribution.

The growth and distribution of the aquatic vascular plants in nine lakes in western Massachusetts were examined in the field for two growing seasons. The objective of the study was to relate the growth and distribution of the vegetation to trophic levels in acid and alkaline lakes. Environmental parameters monitored included pH, total alkalinity, Secchi transparency, temperature, dissolved oxygen and conductivity. Nutrient levels were found by analysis of surface lake waters and plant shoot tissues for nitrogen and phosphorus. No significant correlations were obtained in these analyses. The distribution of the aquatic vegetation was correlated with total alkalinity and conductivity. Three groups of species were noted, those of waters with an alkalinity greater than 40 ppm CaCO3, those of waters with an alkalinity less than 40 ppm CaCO3, and those occurring regardless of alkalinity. Substrate also exerted a strong influence on plant distribution. No plants were found growing below the thermocline in the lakes sampled. Vegetative growth of the aquatic plants generally followed a standard growth curve. The standing crop was correlated with growth form and depth. Standing crops ranged from 0.3 to 420 g/m2 dry wt. Some difficulty was encountered in correlating plant growth with other parameters of trophic level.
W71-03918

INFLUENCE OF TEMPERATURE AND PHOTOPERIOD ON GROWTH, FOOD CONSUMPTION AND FOOD CONVERSION EFFICIENCY OF CHANNEL CATFISH,
Arkansas Univ., Fayetteville. Dept. of Zoology.
R. V. Kilambi, J. Noble, and C. E. Hoffman.
Available from NTIS as PB-197 119, $3.00 in paper copy, $0.95 in microfiche. Preprint, Proceedings of the 24th Annual Conference, S. E. Association of Game and Fish Commission, 1970. 11 p, 4 tab, 4 fig, 12 ref. OWRR Project A-007-ARK (6).

Descriptors: *Photoperiodisms, *Temperature, Growth, *Channel catfish, Food conversion, *Catfishes, Fishes, Fish food organisms.

A total of 275 channel catfish, measuring on the average of 21.4 mm in total length were raised in the laboratory for 120 days under controlled temperatures of 26, 28, and 32 C with 10-hr and 14-hr photoperiods. Data on growth, food consumption, food conversion efficiency, and water quality were collected at 15-day intervals. Analysis of length-weight relationship showed that the experimental conditions had no effect on body shape. The fish under 28C-10L had slow growth in length throughout the study period. Variations in food consumption and food conversion efficiency in 15-day intervals were discussed. Average food consumption and food conversion efficiency for the entire study period were discussed in relation to temperature-photoperiod combinations. The fish at 28 and 32 C consumed more food under 10-hr than under 14-hr light conditions. There was a direct relationship between photoperiod and food conversion efficiency for the fish at all the three temperatures. Based on overall evaluation of growth, food consumption, food conversion efficiency, water quality, and mortalities, it was concluded that the optimum condition for raising channel catfish was at 32 C under a 14-hr photoperiod.
W71-03920

WATER QUALITY - BENTHIC INVERTEBRATE RELATIONSHIPS IN ESTUARIES,
Maine Univ, Walpole, Ira C. Darling Center for Research, Teaching and Service.
David Dean, and Michael A. Mayurkiewicz.
Available from NTIS as PB-197 121, $3.00 in paper copy, $0.95 in microfiche. Project Completion Report, June 1970. 31 p, 11 tab, 9 fig, 11 ref. OWRR Project A-011-ME (5).

Descriptors: *Benthic, Fauna, Benthos, *Estuaries, Fish, Larvae, Maine, Sediments, Water quality, *Larvae, Growth stage, Estuarine environment, *Aquatic environment, Water pollution, Water pollution effects.
Identifiers: Fish growth, Penobscot estuary, Damariscotta estuary, Sheepscot estuary.

This is a study of the relationships between water quality and benethic invertebrates in the Penobscot, Damariscotta and Sheepscot estuaries, representing heavily polluted, moderately polluted and relatively unpolluted conditions, respectively. Preliminary hydrograhic, sedimentary and faunal surveys were conducted to determine comparable areas in each estuary to be analyzed for interaction between level of pollution and invertebrate benthic fauna present. Field studies conducted in each area included an analysis of the qualitative and quantitative distribution of benthic invertebrates, the seasonal composition of the meroplankton, the set-

tlement of larvae and the hydrography of the area. Laboratory studies included: (1) the determination of particle size distribution of sediments and the amount of volatile solids present; (2) the facility with which different indigenous species of benethic invertebrates can be cultured in the laboratory; (3) the temperature, dissolved oxygen and salinity tolerances of larvae and adults; (4) experiments on temperature as a factor influencing the spawning of adults; (5) the influence of different substrates upon larval settlement; (6) the effect of water quality upon survival, reproduction, development and growth of benethic invertebrates.
W71-03922

THE EVALUATION OF ENVIRONMENTAL ALTERATION BY THERMAL LOADING AND ACID POLLUTION IN THE COOLING RESERVOIR OF A STEAM-ELECTRIC STATION,
Missouri Water Resources Research Center, Columbia.
Arthur Witt, Jr., Robert S. Campbell, and James R. Whitley.
Available from NTIS as PB-197 265, $3.00 in paper copy, $0.95 in microfiche. Completion Report, Missouri Water Resources Research Center, August 31, 1970. 99 p, 21 tab, 15 fig, 21 ref, append. OWRR Project A-020-MO (1).

Descriptors: *Thermal pollution, *Acid mine water, *Fish harvest, *Fish reproduction, *Growth rates, *Periphyton, Primary productivity, Limnology, Fish migration, Benthos, Reservoirs, *Heated water, Thermal stratification, Temperature, Bass.
Identifiers: Shad.

Acid water caused low mortiality of fishes only at the point of inflow. Acid water of high specific gravity could be traced within the lake by sulfate levels and conductance until diluted. Thermal stratification occured in the reservoir, but was transitory due to wind action and mixing. Movement of heated water was dependent on wind direction, which was evident by changing patterns of open water during ice cover. A maximum temperature of 34C and minimum of 10C was recorded in an arm of the reservoir that received heated water. Growth rates of young-of-the gizzard shad were not influenced by the heated water. Gizzard shad and largemouth bass concentrated in the heated water during winter and maintained a winter fishery. The heated water affected gonadal development and accelerated the time of spawning of largemouth bass. There was no difference between rates of accrual of Aufwuchs in heated and unheated water in the reservoir.
W71-04019

BIODEGRADABILITY OF POTENTIAL ORGANIC SUBSTITUTES FOR PHOSPHATES,
Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio. Cincinnati Water Research Lab.
For primary bibliographic entry see Field 05D.
W71-04072

EFFECTS OF WASTE DISPOSAL INTO MARINE WATERS - A SURVEY OF STUDIES CARRIED OUT IN THE LAST TEN YEARS,
Engineering-Science, Inc., Arcadia, Calif.
Harvey F. Ludwig, and P. N. Storrs.
Water Research, Vol 4, No 11, p 709-720, November 1970. 12 p, 14 ref.

Descriptors: *Water pollution effects, *Sea water, *Reviews, Waste disposal, Eutrophication, Estuaries, Bays, Water pollution control, Water pollution treatment, Publications, Surveys.
Identifiers: Marine outfalls.

Recent studies of the effects of waste discharges on marine waters are reviewed. There is a common pattern in the variations of abundance and species diversity with distance from the outfall. In the immediate vicinity of the outfall inhibition of biological populations is usually observed. This is evidenced by very low values of both abundance and diversity, and it is particularly apparent for fixed or relatively non-mobile organisms. At some distance from the outfall organism abundance may increase greatly to levels significantly above the average for the area. In this region the species diversity will also have increased, although it will still be less than the area average. Finally, at a greater distance from the outfall the levels of both diversity and abundance return to the normal 'background' level. It is inferred that most waste waters, as presently discharged, have a toxic or inhibitory effect in addition to their biostimulatory characteristics. The toxicity of the waste water is controlling in the immediate vicinity of the outfall, but with the reduction of toxicity by dilution, the biostimulatory effects come to the fore permitting the increased organism abundance noted above. Over the past decade a great deal has been learned about effects of waste materials on marine receiving waters. (Knapp-USGS)
W71-04114

EFFECT OF SOLID WASTE DISPOSAL ON GROUNDWATER QUALITY,
California State Dept. of Water Resources, Los Angeles. Southern District.
Jack J. Coe.
Journal of American Water Works Association, Vol 62, No 12, p 776-783, December 1970. 8 p, 9 fig, 5 tab, 12 ref.

Descriptors: *Landfills, *California, *Water pollution sources, Path of pollutants, Water pollution control, Carbon dioxide, Organic matter, Water quality, Groundwater movement, Waste disposal, Biodegradation.
Identifiers: Sanitary landfills.

Municipal solid wastes are produced in California at a rate of about 7 lb/per capita per day. Most of this waste is disposed of in sanitary landfills. Gas movement rates were found to be 0.22 to 0.8 ft per day vertically and 0.24 to 1.4 ft per day horizontally in undisturbed alluvial soils. Groundwater is often imparied by refuse decomposition products whenever water is allowed to pass through the decomposed material in such quantities as to eventually reach the groundwaters of the area. Leachate impairment of groundwater causes temporary increases in organic material and permanent increases in mineral constituents. Impairment is typified by increases in total dissolved solids, total hardness, chloride, and sulfate. Such increases may last several years. Carbon dioxide effects on groundwater are increases in hardness and bicarbonate. Depending on the pH after carbon dioxide adsorption, water may become corrosive. By modifying a site-usually by the construction of a physical barrier-the groundwater can be protected. (Knapp-USGS)
W71-04116

A NEW FRESHWATER CENTRIC DIATOM MICROSIPHONA POTAMOS GEN. ET SP. NOV.,
Federal Water Pollution Control Administration, Cincinnati, Ohio. Analytical Quality Control Lab.
Cornelius I. Weber.
Journal of Phycology, Vol 6, p 149-153, 1970. 3 fig, 2 tab, 13 ref.

Descriptors: *Phytoplankton, *Diatoms, *Bioindicators, *Water quality, Sampling, Water temperature, Dissolved oxygen, Biochemical oxygen demand, Hydrogen ion concentration, Hardness (Water), Phosphorus, Nitrogen, Chlorides, Sulfates, Water pollution, Delaware River, Hudson River, Ohio River, Mississippi River, Missouri River, Columbia River.
Identifiers: *Little Miami River, *Microsiphona potamos, Connecticut River, Susquehanna River, Chattahoochee River, Maumee River, Great Miami River, Scioto River, Wabash River, Illinois River, Arkansas River, Big Sioux River, Red River, Sacramento River, San Joaquin River, Snake River, Sample preservation.

Analysis of weekly surface grab samples taken from the Little Miami River at Water Pollution Surveillance System Station 90 showed the presence of a new centric diatom microsiphona potamos gen. et sp. nov. (family Coscinodiscaceae). The cells are three to four microns in diameter, four to eight microns long, and contain two to several plate-like chromatophores. They occur singly, or are held together in short chains by the old girdle bands and by numerous apiculi that connect the opposing values of adjacent daughter cells. Cell densities in the grab samples ranged from 29 to 20,140 per ml during the period May 18 to December 14, 1966. Total nitrogen and phosphorus concentration over the sampling period averaged 2.3 and 0.46 mg/l, respectively, indicating high levels of available nutrients. The water was also highly alkaline. Microsiphona potamos was not observed until the water temperature reached 18C and was abundant until water temperatures fell below 10C. The same species has been observed in grab samples from rivers throughout the United States, suggesting that it is an important element of the freshwater phytoplankton of the United States. Descriptive features and electron micrographs of the diatom are included as well as data on the temperature DO, BOD, total phosphorus, total nitrogen, chloride, alkalinity, hardness, and sulfate levels. (Little-Battelle)
W71-04193

PERIPHYTON BIOMASS-CHLOROPHYLL RATIO AS AN INDEX OF WATER QUALITY,
Federal Water Pollution Control Administration, Cincinnati, Ohio. Analytical Quality Control Lab.
For primary bibliographic entry see Field 05A.
W71-04206

USING MACROINVERTEBRATE COLLECTIONS FOR WATER QUALITY MONITORING IN THE OHIO RIVER BASIN 1963-1966,
Federal Water Pollution Control Administration, Cincinnati, Ohio. Div. of Pollution Surveillance.
William T. Mason, Jr., and Philip A. Lewis.
Available from: EPA WQO, Analytical Quality Control Laboratory, 1014 Broadway, Cincinnati, Ohio 45202. Paper 16th Annual Meeting of the Midwest Benthological Society, Wisconsin University, Madison, April 18-19, 1968. 14 p, 2 tab.

Descriptors: *Bioindicators, *Sampling, *Benthic fauna, *Ohio River, Bioassay, Diptera, Mayflies, Lacewings, Crustaceans, Annelids, Mollusks, Nematodes, Stoneflies, Monitoring, Pennsylvania, Ohio, West Virginia, Kentucky, Indiana, Illinois, Sampling.
Identifiers: *Kanawha River, Basket sampler, Ekman dredge, Petersen dredge, Monongahela River, Allegheny River, Wabash River, Trichoptera, Odonata, Coleoptera, Bryozoa, Collenterata, Porifera, Turbellaria, Artificial substrates.

Macroninvertebrate populations in the Ohio River have been sampled since 1963 for water quality monitoring by biologists of the Federal Water Pollution Control Administration from the Division of Pollution Surveillance. Ohio River Basin stations sampled regularly include: Ohio River at Pittsburgh, Pennsylvania; Toronto, Ohio; Addison, Ohio; Huntington, West Virginia; Cincinnati, Ohio; Louisville, Kentucky; Evansville, Indiana; and Cairo, Illinois (a station at Marietta, Ohio was added in 1966); and the Ohio River tributaries, Allegheny River and Monongahela River at Pittsburgh, the Kanawha River at London and Winfield Dam, West Virginia, and the Wabash River at New Harmony, Indiana. In most cases the stations are located upstream from major waste sources at the cities. The data presented are from collections taken in the four-year period from 1963-66. In 1963-64, the primary sampling devices were Ekman and Petersen dredges. In 1965, basket sampler (limestone-filled, artificial substrates) were used to complement the dredge sampling. The macroinvertebrate populations of the Ohio River and the Ohio River tributaries are presented in two tables by organism and by sampling site. (McCann-Battelle)

W71-04208

PHYTOPLANKTON, SESTON, AND DISSOLVED ORGANIC CARBON IN THE LITTLE MIAMI RIVER AT CINCINNATI, OHIO,
Federal Water Pollution Control Administration, Cincinnati, Ohio.
For primary bibliographic entry see Field 05A.
W71-04209

A GUIDE TO THE COMMON DIATOMS AT WATER POLLUTION SURVEILLANCE SYSTEM STATIONS,
Federal Water Pollution Control Administration, Cincinnati, Ohio. Div. of Pollution Surveillance.
For primary bibliographic entry see Field 07C.
W71-04210

A STUDY OF PHOTOSYNTHESIS IN CLEAR LAKE, IOWA,
Federal Water Pollution Control Administration, Cincinnati, Ohio.
Cornelius I. Weber.
Iowa Academy of Science, Vol 70, p 79-87, 1963. 4 fig, 4 tab, 11 ref. AEC Contract AT (11-1)59.

Descriptors: *Photosynthesis, *Phytoplankton, Organic matter, Fish, Food chain, Dissolved oxygen, Seston, Carbon radioisotopes, Carbon, Radioactivity techniques, Aquatic productivity, Light intensity, Iowa.
Identifiers: Clear Lake (Iowa), Illumination, Light energy, Inorganic carbon.

The oxygen and carbon-24 methods were used to measure photosynthesis in Clear Lake, Iowa during 1958 and 1959. Differences in the rates of photosynthesis at widely separated stations were generally small. Daily variations in the rate of photosynthesis were not greater than two-fold. The correlation between the rate of photosynthesis and the incident illumination was 0.81, and the efficiency of utilization of incident light energy was 0.72 per cent. The net gain of organic matter at the phytoplankton level during the period May 1 to November 1 was equivalent to 3480 pounds of glucose per acre. The relationship is shown between photosynthesis and total incident light energy for selective days from June 3 thru July 17. Daily photosynthesis curves at one station are given for selective days from April thru July. (McCann-Battelle)
W71-04212

LIMNOLOGICAL FEATURES OF A NORTHERN BROWN-WATER STREAM, WITH SPECIAL REFERENCES TO THE LIFE HISTORIES OF THE AQUATIC INSECTS,
Alberta Univ., Edmonton. Dept. of Zoology.
Hugh F. Clifford.
The American Midland Naturalist, Vol 82, No 2, p 578-597, October 1969. 8 fig, 5 tab, 38 ref.

Descriptors: *Mayfly, *Humic acids, *Water quality, Limnology, Aquatic insects, Subarctic, Aquatic productivity, Water temperature, Biomass, Hydrogen ion concentration, Dissolved oxygen, Phosphates, Color, Turbidity, Stone flies, Diptera, Amphipoda, Gastropods, Oliqochaetes.
Identifiers: *Bigoray River (Alberta), *Fluvic acid, Leptophlebia cupida, Baetis tricaudatus, Trichoptera, Hemiptera, Megaloptera, Anisoptera, Coleoptera, Hiaudinea.

Aquatic invertebrates of a northern brown-water stream of west central Alberta, the Bigoray River, were studied for 2 years. The stream drains extensive muskeg terrain, but the pH of the water is always on the alkaline side; water temperatures are near 0C for 6 months of the year, and the stream is completely ice-covered for 5 months; there is progressively less flow during the winter months. During dry winters, water freezes into the substrate, causing considerable mortality to riffle-inhabiting insects. The stream supports a large and diverse mayfly (Ephemeroptera) fauna with Leptophlebia cupida (Say) and Baetis tricaudatus Dodds accounting for over 50% of the total yearly fauna by numbers and also volume biomass. Life history data are presented for 11 aquatic invertebrates. Compared to faunas of other streams, the Bigoray River has the following pertinent features: (1) a fauna with a restricted emergence period; (2) a short period (5 months) of seasonal succession and a long period (7 months) when the fauna changes very little; (3) various seasonal growth patterns exhibited by individual species, but the fauna as a whole grow most intensely in autumn; (4) a relatively large number of temporary (or summer) may fly species and (5) a winter species fauna having extensive delayed hatching. (McCann-Battelle)
W71-04215

5D. Waste Treatment Processes

SPRAY IRRIGATION OF WASTES FROM THE MANUFACTURE OF HARDBOARD,
Masonite Corp., Chicago, Ill.
Ward C. Parsons.
Industrial Waste Conference, 22nd, May 2, 3, 4, 1967, Purdue University, Vol 52, No 3, July 1968, p 602-607. 4 fig.

Descriptors: *Dissolved oxygen, *Biochemical oxygen demand, *Chemical oxygen demand, *Hydrogen ion concentration, *Soil types, *Climatic data, Sprinkler, Irrigation, Sprays, Waste treatment, Soil-water-plant relationships, Waste water treatment.
Identifiers: Spray irrigation, Hardboard, Hexosans, Glucose, Manose, Galactose, Pentosans, Lignin, Organic acids, Hemicellulose degradation products.

There have been many false notions concerning spray irrigation such as likening this process to a gigantic sand filter. Purification of waste by this method is the direct result of two basic natural phenomena; natural biological reduction and adsorption. Experiments were conducted using the waste water effluent from the production of hardboard to determine the feasibility of using this process in the treatment of waste water. There are advantages and disadvantages to using spray irrigation. The advantages of spray irrigation are: (1) it is simple to operate, (2) operating costs are moderate, and (3) it operates well in dry climates and dry weather. However, there are disadvantages, such as: (1) vast acreage is required, (2) knowledge of subsurface conditions is required, (3) rainy weather causes drainage problems, (4) high power costs, (5) possible salt concentrations, and (6) supersaturation. The author cautions the engineers to consider all the parameters involved in spray irrigation prior to selecting this method for treatment of waste. (Ellis-Texas)
W71-03886

WASTE PROBLEMS RELATIVE TO MINING AND MILLING OF MOLYBDENUM,
New Mexico Bureau of Mines and Mineral Resources.
Roshan B. Bhapper, John H. Fair, and John R. Wright.
Industrial Waste Conference, 22nd, May 2, 3, 4, 1967, Purdue University, July 1968, p 575-592. 4 fig, 4 tab.

Descriptors: *Flotation, *Filtration, *Groundwater movement, *Mine wastes, Water pollution sources, Excavation, *Molybdenum, New Mexico, Waste water treatment, Mine drainage, Acid mine water.
Identifiers: *Questa Mine (N Mex), Molybdenite, Cyanide, Complexing Agents, Tailings Pond.

The problem of molybdenum mining and its resultant processes are presented here. A brief resume of the history of the Questa Mine, its geologic setting, mining and milling operations, and the milling chemistry of molybdenum is included. Sportsmen and conservationists became alarmed at observed tailings, frothing of the water, and fish kills as a result of mining and processing. Public opinion became quite strong when it was found that 'cyanide' was used in the process. Studies of line boxes and aquariums indicated the toxicity of the waste. Analysis of the Red River and causes of fish deaths were conducted by Federal agencies. Changes in the milling chemistry helped resolve the problems that the mining industry encountered. (Ellis-Texas)
W71-03888

DESIGN OF PLUGFLOW POST AERATION BASIN,
Rex Chainbelt Inc., Milwaukee, Wis.
Richard A. Kormanik.
Journal Water Pollution Control Federation, Vol 42, No 11, p 1922-1931, November 1970. 5 fig, 2 ref.

Descriptors: *Mathematical models, *Reareration, *Dissolved oxygen, Mechanical control, Design, Mixing, Diffusion, Aeration, Waste water treatment.
Identifiers: *Post aeration basins, Surface aerators, Final effluent, Plug flow, Aerator spacing, Oxygen transfer coefficient, Diffused aeration, Detention time.

A mathematical design procedure has been developed for use in designing plug flow post-aeration basins. These basins raise the dissolved oxygen level of final effluent from a waste treatment plant up to levels acceptable to the appropriate regulatory agency. The mathematical formulas are derived in a step-by-step approach. The advantage to the mixing basin is that the dissolved oxygen level may be closely controlled, whereas in a flume or spillway device there is no means of control. Studies revealed that when no detectable oxygen utilization rate was present, then detention time ceased to be a controlling parameter in the re-aeration system. (Lowry-Texas)
W71-03889

FLORIDA FIRM USES GAMMA RAYS TO POLISH SEWAGE PLANT EFFLUENT.

Engineering-New-Record, p 24-25, August 13, 1970.

Descriptors: *Sewage treatment, *Gamma rays, *Nuclear energy, *Water reuse, *Tertiary treatment, Chlorine, Virus, Diatomaceous earth, Activated carbon, Cobalt, Detergents, Pesticides, Waste water treatment, Sewage effluents.
Identifiers: Irradiation, Extended aeration package plant.

Energy Systems, Inc. of Melbourne, Florida, has designed, built, and operates a small treatment plant in Palmdale, Florida which uses nuclear irradiation to kill viruses, break down 96% of all detergents, break down some pesticides, kill 100% of fecal coliform, and 99.99% of general coliform. DO is generally around 6 ppm and BOD is less than 15 ppm. This system utilizes an extended aeration package plant followed by six slim rods of cobalt 60 housed in 14x14x9 ft. reinforced concrete structure. Effluent from the irradiator is of such quality that it could be used for irrigation while passing this effluent through a diatomaceous earth filter would meet FWQA standards for discharge into a stream. If the waste is to be recycled the effluent from the diatomaceous earth filter must be passed through carbon filters. There is no detection of radiation emission outside of the building nor is there any trace of radioactivity in the effluent. Some discussion of the cost of installation and operation is also included. (Ellis-Texas)
W71-03890

ANAEROBIC DIGESTION FAILURES,
Bergen County Sewer Authority, Little Ferry, N.J.
Stanley A. Peterson, and Herman R. Zablatzky.
Journal Water Pollution Control Federation, Vol 40, No 4, p 581-585, April 1968. 2 fig, 5 tab, 3 ref.

Descriptors: *Anaerobic digestion, *Alkalinity, Lagoons, Hydrogen ion concentration, Waste water treatment, Sludge, *Sludge digestion, Digestion (Decomposition).
Identifiers: Isolation, *Ammonium alkalinity, Thickeners, Volatile acids, Gas production, Sodium hydroxide, Potassium hydroxide, Calcium oxide, Gas agitation.

Two separate incidents of digester failure are discussed, along with the materials and methods used to help them recover. Parameters of pH, alkalinity, CO2 content, volatile acids content, and gas production were continuously monitored and that data is presented in graphical form. Underconcentration of feed sludge may lead to failure by the depletion of alkaline buffering materials. Over concentration of feed sludge allows buildup of ammonium alkalinity to toxic levels. One of the essentials of good digester maintenance is early diagnosis of problems through close observance of the major parameters. Ideal sludge concentration varies from plant to plant and must be determined by the individual operator. (Lowry-Texas)
W71-03891

PROTOTYPE STUDIES OF COMBINED TREATMENT OF WASTES FROM 22 TANNERIES AND TWO MUNICIPALITIES,
Syracuse Univ., N.Y. Dept. of Civil Engineering.
N. L. Nemerow, and R. Armstrong.
Industrial Waste Conference (22nd), Purdue University, p 593-601, 1968. 5 fig, 2 tab, 2 ref.

Descriptors: *Alkaline water, *Biochemical oxidation demand, *Chromium, *Sulfur compounds, Biological treatment, Screens, Settling basins, Pumps, Filters, Activated sludge, Aeration, Digestion, Waste water treatment, New York.
Identifiers: *Tannery wastes, *Sulfites, Cayadutta Creek, Gloversville (NY), Dortmund settling tanks, Glue manufacturing, Textile dying, Roughing filters, Aeration tanks.

A prototype plant was constructed in 1965 at the existing Gloversville waste water treatment plant to treat the combined waste from tanneries, textile dying plants, and municipalities. These wastes were effectively treated in a two stage biological plant using the activated sludge process preceded by a roughing filter. Biochemical Oxygen Demand reductions were obtained in the range of 80-90 percent, there was no odor problem, and varying the pH did not appear to affect the treatment. Color removal was obtained 100 percent of the time, however, complete color removal was not obtained all the time. Two sets of tests were run, the first without polyelectrolytes, and the second, with polyelectrolytes. Polyelectrolytes enhanced the Biochemical Oxygen Demand removal and suspended solids removal. (Ellis-Texas)
W71-03892

COMPUTER DESIGN OF SEWAGE TREATMENT PLANTS,
Technicomp, Inc., Great Neck, N.Y.
James J. DeGroat, Bruce A. Pomeroy, and Robert E. Hagadorn.
Public Works, Vol 101, No 11, p 51-53, November 1970.

Descriptors: *Sewage treatment, *Computer simulation, *Mathematical models, Design, Automation, Waste treatment, Programming languages, Specifications, Design, Waste water treatment.
Identifiers: Computerized drafting machines, Fortran IV, IBM 1130.

Technicomp Corporation, under contract to the Federal Water Quality Administration, has developed a program which performs all design calculations and specifications not requiring engineering judgement. Size and weight criteria were established, and information on all available equipment fed directly into the program. The program is written in Fortran IV, and especially for the IBM 1130 computer which is common to many consulting engineering offices. Output is from a UDM drafting machine. It includes not only the drawings but all specifications as to wall thicknesses, pipe diameters, flows, valving, and equipment selected. The entire process requires a minimum of 2 weeks time of the sanitary engineering, and the computer programmer. This process presently required, depending on the manpower available, up to a year or more. Detailed cost figures are not available but estimates indicate the process to be substantially cheaper. Also, slight modification would allow applicability to many different process industries. (Lowry-Texas)
W71-03893

MULTI-STAGE BIOLOGICAL PROCESSES FOR WASTE TREATMENT,
Deering Milliken Research Corp., Spartanburg, S.C.; and Clemson Univ., S.C.
Eugene P. Willimon, Jr., and John F. Andrews.
Industrial Waste Conference (22nd), May 2, 3, 4, 1967, Purdue University, Vol L II, No 3, p 645-660, July 1968. 12 fig.

Descriptors: *Waste treatment, *Microorganisms, *Chemical oxygen demand, *Hydrogen ion concentration, Retention, Volatility, Anaerobic bacteria, Anaerobic conditions, Anaerobic digestion, Aerobic conditions, Aerobic treatment, Aeration, Methane, Waste water treatment.
Identifiers: Multi-stage biological processes, *Multi-stage digestion, Removal rate, Retention time, Volatile suspended solids, Volatile acids.

The authors conducted experiments to show the value of using more than one stage of waste treatment. By using a two stage system, the reactions could be separated and optimized independently of each other. One of the examples shown is the removal of nitrogen from wastes as proposed by Wuhrmann. In this process all of the nitrogen compounds are oxidized under aerobic conditions to NO2 and NO3 in the first stage, and under anaerobic conditions in the second stage where the oxides are reduced by denitrifying bacteria to the gaseous products of N2 and N2O which readily separates from the liquid phase of the waste. The study conducted by the authors consisted of two parts: (1) a series of single stage experiments designed to explore the effects of pH and aeration rate on the effluent composition at low retention times; and (2) a series of multi-stage experiments designed to compare a multi-stage system with a single-stage system using pH control in both systems and limited aeration in the first stage of the multi-stage system. Many analytical tests were conducted and the information on the improved Chemical Oxygen Demand reductions and removal rates for the two stage system was typical of the advantages observed for the multi-stage process. The definite effect of pH illustrates the need for closer control over environmental parameters on present and future processes. (Ellis-Texas)
W71-03894

A LONG-TERM PLAN FOR SEWERAGE DEVELOPMENT IN THE JOHANNESBURG REGION,
Johannesburg City Engineer's Dept. (South Africa).
For primary bibliographic entry see Field 05G.
W71-03895

DESIGN CONSTRUCTION AND MAINTENANCE OF WASTE STABILIZATION LAGOONS,
Farmers Home Administration, Champaign, Ill.
David H. Stoltenberg.
Public Works, Vol 101, No 9, p 103-106, September 1970. 4 fig, 3 tab, 17 ref.

Descriptors: *Oxidation lagoons, *Stabilization, *Algae, Aerobic treatment, Bacteria, Municipal wastes, Biochemical oxygen demand, Waste water treatment.
Identifiers: Depth, Slope, *BOD loading, *Waste stabilization.

There are several important factors involved in waste stabilization using lagoons. The fact that oxygen is produced by algae during the day and consumed by algae at night is presented as a critical factor in lagoon design and maintenance. The variance of allowable biochemical oxygen demand loading with geographical location is also discussed. Construction costs are also presented. Estimates range from $11 to $18 per capita for installations serving 1000 people, and from $30 to $36 per capita for installations serving 100 people. Operation and maintenance costs are estimated to be one-fourth, or one-fifth of the cost for conventional waste treatment. (Lowry-Texas)
W71-03896

DESIGN OF ACTIVATED CARBON ADSORPTION BEDS,
Maryland Univ., College Park. Dept. of Civil Engineering.
John T. Cookson, Jr.
Journal Water Pollution Control Federation, Vol 42, No 12, p 2124-2134, December 1970. 7 fig, 1 tab, 10 ref.

Descriptors: *Activated carbon, *Absorption, *Liquid wastes, *Sewage treatment, *Water purification, Tertiary treatment, Solids contact process, Hydrogen ion concentration, Mass transfer, Boundary processes, Boundary layer, Reynold's number, Waste water treatment.
Identifiers: Attachment, *Transport, Langmuir Isotherm, Von Karmon integral relation, Colburn factor, Sherwood Number, Schmidt Number.

Activated carbon beds offer an effective means of removing organics that exist in very low concentrations. In this process, variables of importance are flow rate, bed height, void fraction, available adsorption area per bed volume, bed particle, size, and the past history of the adsorption bed. An evaluation of a mathematical model is conducted. This model utilizes the theory of mass transfer, based on the thin boundary layer solution of the diffusion equation and the adsorption equilibrium distribution of solute between the stationary and moving phases. The validity of the model is examined by studies on the removal of the virus bacteriophage T4 in packed beds of activated carbon. Virus adsorption on activated carbon can be correlated by the Langmuir isotherm and the validity of the adsorption model to predict the capacity and breakthrough concentration is illustrated. Experimental mass transfer coefficients gave excellent correlation with the Reynold's Number as predicted by Pfeffer and Happel's model which extends mass transfer theory to include multiparticle systems. A simplified design procedure is included. (Ellis-Texas)
W71-03897

MINE WASTE WATER PROBLEMS IN EUROPE,
Pennsylvania Dept. of Mines and Mineral Industries, Harrisburg.
David R. Maneval.
Industrial Waste Conference (22nd), May 2, 3, 4, 1967, Purdue University, July 1968, p 608-619. 9 fig.

Descriptors: *Mine acids, *Sedimentation, *Carbon dioxide, *Hydrogen ion concentration, Water pollution, Waste treatment, Watersheds, Filtration coagulants, Coal mine wastes, Water purification, Acidic water, Water pollution control, Waste water treatment.
Identifiers: United Kingdom, Netherlands, West Germany, Belgium, Back flushing, Emscher River Basin (W Ger).

This is an analysis of how Europeans are combatting the water pollution problems caused by mining. Europeans are realizing the need for community effort and are relying increasingly on river basin authorities and river boards. Probably the most interesting method is used in the Emscher River Basin. The Emschergenossenschaft was established in 1004 with the role of regulating the

purifying waste waters. It is the only agency of its type to provide waste treatment for the entire river flow. Europeans have found that it is of great importance and benefit to conduct a well coordinated research program in mine drainage and preparation plant effluents. Most European countries are ahead of the United States in research and the abatement of pollution caused by coal processing plants. Several methods of waste treatment are included in this article indicating how various European countries have treated the effluent from mines and preparation plants. (Ellis-Texas)
W71-03898

WASTE CONTROL HIGHLIGHTS PLANT DESIGN.

Environmental Science and Technology, Vol 4, No 11, p 898-900, November 1970.

Descriptors: *Re-cycle, *Recovery, Concentration, Segregation, Fermentation, Biochemical, Industrial wastes, Monitoring, Cooling, Environmental control, *Water reuse, Waste water treatment, Indiana, Treatment facilities.
Identifiers: Spent fermentation broth, Dilute chemical wastes, Concentrated chemical wastes, *Watery process wastes, Clinton (Ind).

Eli Lilly and Company has designed and built a new fermentation plant at Clinton, Indiana. This plant is designed for total environmental security, regardless of cost involved. Any recoverable chemicals will be recovered regardless of cost. All waste streams will be treated individually for better treatment. Less than 2,500 lb. BOD per day will enter the Wabash River in a waste stream of no more than .1% of the mean river flow. 90% of total water used in the plant in all processes will be recycled. If start-up problems involved can be surmounted, this plant should be the forerunner of many new plants designed to protect the environment, not only in the biochemical field, but in all industries. (Lowry-Texas)
W71-03899

CHEMICAL PRECIPITATION OF PHOSPHATE WITHIN A HIGH RATE BIO OXIDATION SYSTEM I. SYNTHETIC SEWAGE STUDIES,
Pennsylvania State Univ., University Park. Dept. of Civil Engineering.
W. A. Eberhardt, and J. B. Nesbitt.
Industrial Waste Conference (22nd), May 2, 3, 4, 1967, Purdue University, Vol 52, No 3, July 1968, p 100-119. 6 fig, 7 tab, 32 ref.

Descriptors: *Chemical precipitation, *Phosphate, *Activated sludge, Pilot plant, Biodegradation, Chemical treatment, Biological treatment, Waste water treatment, Sewage treatment.
Identifiers: Bio-chem process, Combined chemical-biological treatment, Aluminum-Phosphorus ratio, *Phosphorus removal, Multi-stage processes.

The Bio Chem process is a combined chemical-biological treatment process capable of effecting low phosphorus residuals while at the same time producing a low effluent Biochemical Oxygen Demand. Using only three system components... a combined aeration, chemical mixing, and coagulation basin having a 2.7 hour detention time, a clarifier, and filtration... total phosphorus residuals and BOD5 removals averaged, respectively, .19 milligrams phosphorus as phosphate per liter and 94.8% over a 35 day run. This process is compared with other processes used when both phosphorus and biochemical oxygen demand in the effluent must be low. The Bio-chem process is shown to be the most economical without sacrificing the efficiency of the biological treatment operation. (Lowry-Texas)
W71-03900

A COMPREHENSIVE WATER QUALITY CONTROL PROGRAM FOR THE LAS VEGAS WASH DRAINAGE BASIN. PHASE I.
Boyle Engineering, Las Vegas, Nev.; and Cornell, Howland, Hayes, and Merryfield, Las Vegas, Nev.

Report to the Board of Commissioners of Clark County, Nevada, February 1969. 185 p, 25 fig, 45 tab, 90 ref. C 5021.0, 87-0922-00-00.

Descriptors: *Water quality control, *Urbanization, *Water pollution control, *Water resources development, *Waste water treatment, *Planning, Hoover Dam, Colorado River, Nevada.
Identifiers: *Las Vegas Valley, *Lake Mead, Las Vegas Wash.

A long-range water resource management program was developed for optimization of the beneficial uses of the total water resources in the Las Vegas Valley and the protection of these resources for future generations. Phase I discusses the work necessary to isolate and define the overall problem and make recommendations for selection of a management agency to implement the program. The study area includes about 2,200 square miles in the Las Vegas Valley tributary to the Las Vegas Wash into Lake Mead. The following recommendations are made: (1) That Phase II be authorized immediately to expedite the detailed program formulation and enable full activation of initial operational capability by mid-1972; (2) That the Las Vegas Valley Water District be designated as the agency responsible for the management of water resources and water quality control. It is further recommended that this decision be made soon in order to permit the District to initiate constructive discussion with other agencies. Operational and financial decisions may, in that way, be incorporated into the Phase II program; (3) That the Las Vegas Valley Water District Act should be revised to give the District specific authority to collect, treat, and dispose of sewage, waste and storm waters. (See also W71-03902) (Poertner)
W71-03901

A COMPREHENSIVE WATER QUALITY CONTROL PROGRAM FOR THE LAS VEGAS WASH DRAINAGE BASIN.
Boyle Engineering, Las Vegas, Nev.; and Cornell, Howland, Hayes, and Merryfield, Las Vegas, Nev.

Report to the Board of Commissioners of Clark County, Nevada, December 1969. 146 p, 16 fig, 46 tab, 41 ref. C 5021.0, 87-0922-00-00.

Descriptors: *Water quality control, *Tertiary treatment, *Urbanization, *Waste water treatment, *Water pollution control, Hoover Dam, Colorado River, Groundwater recharge, Reservoir evaporation, Hydroelectric power, Irrigation, Desalination, Nevada.
Identifiers: *Las Vegas Valley, *Lake Mead, Las Vegas Wash.

A comprehensive water quality control program is described for the Las Vegas Drainage Basin. A summary of the conclusions and recommendations reached in the Phase I report is included. Volume II presents conclusions and recommendations. A number of possible combinations of treatment and/or disposal techniques to meet the needs of the Las Vegas Valley area have been studied. These include: in-valley irrigation; exportation to five different hydrogeologically isolated areas; combined irrigation and exportation; groundwater recharge; an area-wide collection, treatment and disposal system terminating at the Colorado River below Hoover Dam; and complete treatment to meet effluent standards for Lake Mead disposal. Similarly, a variety of treatment processes were investigated to meet the needs of the various overall alternates. These processes range from no additional treatment through simple filtration to sophisticated desalinization processes. In-depth comparisons were made on four basic alternate plans as follows: (1) Groundwater basin recharge, (2) Exportation to Eldorado and Dry Lake Valleys, (3) Las Vegas Valley waste water collection and treatment system, and (4) Complete treatment. The Las Vegas Valley waste water collection and treatment system is shown to provide the most economical solution to the overall problems of waste water treatment and disposal of any of the alternates studied. This plan envisions collection of secondary effluents and industrial waste waters, tertiary treatment and discharge below Hoover Dam. (See also W71-03901) (Poertner)
W71-03902

SANTEE PROJECT CONTINUES TO SHOW THE WAY,
Santee County Water District, Calif.
E. W. Houser.
Water and Wastes Engineering, May 1970. 5 p, 2 fig.

Descriptors: *Tertiary treatment, *Water reuse, *Municipal wastes, *Sewage treatment, *Waste water treatment, Cities, Urbanization, Reclaimed water, Water shortage, Water conservation, Recreation, Oxidation lagoons, Anaerobic digestion, Electrodialysis, Ion exchange, California.
Identifiers: *Santee County Water District (Calif).

A historical account is given of the Santee County Water District's successful pioneering efforts to solve waste water disposal problems and, at the same time, to make better use of its increasingly expensive water supplies through the development of better water management practices. This approach necessitated the development of a waste water reclamation system capable of returning municipal waste water to a level of quality that made possible reuse for purposes higher than limited irrigation. It was also necessary to break the 'regulation barrier' that had previously limited the use of sewage treatment plant effluents to golf course irrigation and the irrigation of crops not directly consumed by people. A tertiary treatment plant has been placed in service and its effluent is transported to adjacent recreation lakes. The biological process reduces nitrates to gaseous nitrogen through anaerobiosis of the activated sludge. Phosphates are then removed by chemical additions, flocculation, and settling. Alum and lime are the primary chemicals used. The next stage is filtration through dual media filters to produce an effluent with less than 1.0 mg/liter suspended solids. The water is chlorinated before release to the lakes. Future plans are to intercept a portion of the flow, after filtration, for demineralization and passage through deep carbon filters. Half of this flow will then pass through an ion-exchange unit and half through an electrodialysis unit. The total dissolved solids of this effluent will be below that of the raw drinking water supplied to the Santee population. (Poertner)
W71-03904

WATER TRANSPORT THROUGH PLASTICIZED MEMBRANES,
Weizmann Inst. of Science, Rehovoth (Israel).
For primary bibliographic entry see Field 03A.
W71-03912

DEVELOPMENT OF ECONOMICAL METHODS OF BORON REMOVAL FROM IRRIGATION RETURN WATERS,
Aerojet-General Corp., El Monte, Calif.
R. M. Roberts, and L. E. Gressingh.
For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D.C. 20402. Price: $1.50. Office of Saline Water Research and Development Progress Report No. 579, July 1970. 115 p, 21 tab, 20 fig, 41 ref, append. OSW Contract 14-01-0001-1775.

Descriptors: *Water reuse, *Irrigation water, *Return flow, Desalination, Boron, Osmosis, *Reverse osmosis, Waste water treatment.
Identifiers: *Boron removal, Irrigation return water.

The objective of this program has been to investigate and develop methods that are economically feasible for reducing to nonphytotoxic levels the boron content of irrigation return waters that have been renovated by reverse osmosis treatment. In consideration of economic and technical factors, only one method among the conventional and novel techniques investigated offers immediate promise of successful application. This method is based on a discovered process modification in which Amberlite XE-243, a commercial (Rohm and Haas Co.) boron complexing resin, is used. A small (3 KGAL/day) system has been designed which will permit the field evaluation of this process in the deboronation of permeate from a reverse osmosis system. (Wheeler-Office of Saline Water)
W71-03914

ENGINEERING EVALUATION OF FACTORS AFFECTING QUALITY OF WATER SOURCES AVAILABLE FOR SALINE WATER CONVERSION PLANTS,
Powell (Sheppard T.) and Associates, Baltimore, Md.
For primary bibliographic entry see Field 03A.
W71-03916

PREDATOR-PREY RELATIONSHIPS IN A MODEL FOR THE ACTIVATED PROCESS,
Michigan Univ., Ann Arbor. Dept. of Civil Engineering.
Raymond P. Canale.
Biotechnology and Bioengineering, Vol 11, No 5, p 887-907. 9 fig, 25 ref.

Descriptors: *Bacteria, *Protozoa, *Fungi, *Rotifers, Model studies, Waste water treatment, Nutrients, Microorganisms, Activated sludge, Sludge.
Identifiers: *Predator-Prey relationship.

Three differential equations describe the relationships between soluble organic nutrients, bacteria, and protozoa in a continuously fed, stirred tank biological reactor. The system is seen to oscillate widely as differing amounts of each of the three quantities are either synthesized or destroyed. The differential equations were analyzed to characterize the possible types of solutions which could be obtained. A limit cycle solution was obtained for some values of the system parameters. Simplifying assumptions made initially need to be tested by further experimental work. (Lowry-Texas)
W71-04070

BIODEGRADABILITY OF POTENTIAL ORGANIC SUBSTITUTES FOR PHOSPHATES,
Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio. Cincinnati Water Research Lab.
Robert L. Bunch, and M. B. Ettinger.
Industrial Waste Conference, 22nd, May 2, 3, 4, 1967, Purdue University, Vol 52, No 3, p 393-396, July 1968. 1 fig, 14 ref.

Descriptors: *Algae, *Biodegradation, *Phosphates, *Eutrophication, Nutrients, Nitrogen, Waste water treatment, Phosphorous, Runoff, Domestic wastes, Detergents, Industrial wastes, *Chelation.
Identifiers: Urban runoff.

Eutrophication will be an increasingly important problem in the future as more waters are impounded and reused. Consideration should be given not only to improving methods of nutrient removal from sewage influents, but also to finding acceptable substitutes for phosphates in industrial processes and detergent formulations. Private industry can make a contribution by developing economically practical materials which will be converted into innocuous products at a rate sufficiently rapid to prevent significant accumulation of pollutants. It appears that biodegradable chelating agents may be considered as a partial substitute for phosphates in certain types of detergent formulations. The relationship between the structure of chelating agents and the loss of chelating ability due to biological action remains to be answered. Results on compounds now under study should give a better understanding of the type of chelating compounds that would minimize environmental contamination. So far, only compounds containing only ore nitrogen molecule have show biodegradability. It does not seem desirable to use nonbiodegradable chelating agents that strongly complex heavy metals unless it has been demonstrated that they do not interfere with waste treatment, coagulation, water softening, calcium metabolism of man, or convey metals into the drinking water. (Ellis-Texas)
W71-04072

ENGINEERING ASPECTS OF SURFACE AERATION DESIGN,
Texas Univ., Austin. Center for Research in Water Resources.
Wesley W. Eckenfelder, and Davis L. Ford.
Industrial Waste Conference, 22nd, May 2, 3, 4, 1967, Purdue University, Vol 52, No 3, p 279-291, July 1968.

Descriptors: *Activated sludge, *Aeration, *Aerated lagoons, *Oxygen requirements, Transfer, Energy dissipation, Extended aeration, Chemical wastes, Waste water treatment, Industrial wastes, Surfactants.
Identifiers: *Gas transfer, *Oxygen transfer, Entrainment, Refinery wastes, Petrochemical wastes, Liquid film coefficient.

In recent years mechanical surface aerators have become increasingly popular for applications in aerated lagoons and the activated sludge process. When developing aeration design and process application there are several factors which must be considered. These are: (a) the oxygenation efficiency under specified aeration conditions, (b) mixing conditions in the aeration basin, and (c) the oxygen transfer in the aeration liquid relative to water. It has been shown that the oxygenation efficiency of surface aeration units varies with the volume of liquid under aeration. The coefficient alpha can be defined as the ratio of the liquid film coefficients of the waste to that of water. R value for alpha must be used in the design of a surface aeration system and present capabilities for experimentally determining this value is very difficult. Unless more specific information on the prototype aeration unit is available, the minimum alpha value computed from the study should be used for conservative design. Basic principles in the design of surface aeration are included with an example problem. (Ellis-Texas)
W71-04073

THE ANAEROBIC FILTER FOR WASTE TREATMENT,
Stanford Univ., Calif. Dept. of Civil Engineering.
James C. Young, and Perry L. McCarty.
Industrial Waste Conference, 22nd, May 2, 3, 4, 1967, Purdue University, Vol 52, No 3, p 559-574, July 1968. 7 fig, 5 tab, 9 ref.

Descriptors: *Filtration, *Anaerobic conditions, *Biodegradation, *Anaerobic bacteria, Microorganisms, Sewage bacteria, Methane, Chemical oxygen demand, Biological treatment, Waste treatment, Waste water treatment.
Identifiers: *Biological solids production, Effluent quality, Anaerobic filter.

Experiments found that low strength soluble wastes can be treated anaerobically by upflow filtering through rocks. Anaerobic microorganisms collect in the void spaces so that the waste comes in contact with a large biological mass causing a high degree of treatment and an effluent essentially free of biological solids. The advantages of this type of filter are: (1) it is usually suited for treatment of soluble wastes, (2) no recycle is nedded, (3) biological solids remain in the filter, therefore there is little sludge wasting and (4) no addition of heat is required. Aeration or other similar methods can effectively remove any remaining biochemical oxygen demand and sulfides in treated effluent. Power requirements for filter operation are almost nonexistant due to the low head loss through the filter although methane produced from the decomposition of wastes can be used for power supply if this is necessary. Low maintenance of this system is probable and sludge handling and waste disposal are minimized. (Ellis-Texas)
W71-04075

HIGH-RATE BIOFILTRATION: PAST AND FUTURE,
Imperial Chemical Industries Ltd., Brixham (England). Brixham Research Lab.
M. W. Askew.
Water Pollution Control, Vol 69, No 4, p 445-452, 1970. 1 fig, 5 tab, 10 ref.

Descriptors: *Filtration, *Waste water treatment, Sewage treatment, Water pollution treatment, Biochemical oxygen demand, Dewatering, Industrial wastes, Sludge disposal, E. Coli.
Identifiers: *Biofiltration, *Polyvinyl chloride, *Plastics media, Streptococcus faecalis.

The use of filters in waste water treatment is not new and the development of plastic packings for high-rate biofiltration has increased the efficiency and desirability of this system for use where conventional filters or the activated sludge process have been inappropriate. Polyvinyl chloride seems to be the most applicable type of synthetic polymer presently available but with the increase of interest in this process there undoubtedly will be a better, cheaper or more efficient filter in the future. Probably future uses for biofiltration are partial treatment of sewage prior to discharge into coastal waters, and in industry. Public opinion is calling for some kind of treatment and biofiltration offers a comparatively economical means of providing it while the benefits of high rate biofiltration would be a marked reduction in the pathogenic indicator organism counts, and a reduction in the Biochemical Oxygen Demand. Industry may consider this process in water reuse especially where the industry uses a large volume of water. (Lowry-Texas)
W71-04076

THE EFFECT OF SHORT-TERM TEMPERATURE VARIATIONS ON METHANE PRODUCTION,
Texas Univ., Austin. Environmental Health Engineering. Research Lab.
Richard E. Speece, and Jan A. Kem.
Journal Water Pollution Control Federation, Vol 42, No 11, p 1990-1997, November 1970. 8 fig, 2 tab, 9 ref.

Descriptors: *Sludge digestion, *Anaerobic digestion, Waste water treatment, Sludge, Digestion (Decomposition), *Temperature, *Methane.
Identifiers: Methane production, Volatile acids.

Laboratory experiments were conducted using acetate fed into a well-digested mesophilic sludge and varying the temperature for a period of 15-20 minutes. This sludge was also tested at 35C and 45C to observe the relative response of acid forming and methane forming organisms. It was found that raising the temperature increased the activity of the methane formers and also decreased the initial amount of volatile acids present. The varying of temperatures below 20C resulted in negligible methane production but there was no resultant retardation of gas production after restoring the temperature to its normal state inside the digester. (Ellis-Texas)
W71-04077

RESPIRATORY RELATIONSHIPS OF A SYMBIOTIC ALGAL-BACTERIAL CULTURE FOR WASTE WATER NUTRIENT REMOVAL,
Ohio State Univ., Columbus. Dept. of Civil Engineering.

F. J. Humenik, and G. P. Hanna, Jr.
Biotechnology and Bioengineering, Vol 12, p 541-560, 1970. 8 fig, 3 tab, 17 ref.

Descriptors: *Symbiosis, *Algae, *Bacteria, *Respiration, Activated sludge, Waste water treatment, Nutirients, Aerobic conditions, Aeration, Microbiology, Biomass, Chlorella.
Identifiers: *Nutrient removal, Oxygen decline, Respiratory rates, Photosynthetic oxygenation, Activated algae.

Research was conducted to investigate the respiratory relationships of a mixed algal-bacterial culture and the effect of its natural ecological associations on the stabilization of a domestic waste water. In order to do this the authors developed a continuous symbiotic algal-bacterial system of a mixed Chlorella-activated sludge culture which would efficiently remove nutrients from waste water under aerobic conditions and without additional aeration. Daily harvesting of excess biomass was conducted to provide stable relative biological populations and a dissolved oxygen concentration of approximately 2 milligrams per liter was maintained throughout steady state operations. To predict respiratory rates, photosynthetic oxygenation and steady-state oxygen concentrations oxygen decline data were fitted to mathematical models. The respiratory and physiological relationships indicated that the carbon dioxide-oxygen balance may be a primary control governing the steady-state operation of a symbiotic algal-bacterial culture. Microscopic examinations showed that bacteria were attached to algal cells and the Chlorella were integrally enmeshed within the bacterial mix which allowed this algal-bacterial floc to settle quite rapidly and yield a clear supernatant. (Ellis-Texas)
W71-04079

WASTE WATER TREATMENT FACILITIES AT BURNS HARBOR,
Bethelhem Steel Corp., Chesterton, Ind. Burns Harbor Plant.
R. N. Leidner, and R. Nebolsine.
Industrial Waste Conference, 22nd, Purdue University, Vol 52, No 3, p 631-644, May 1967. 16 fig.

Descriptors: *Waste water treatment, Water quality, *Water requirements, Waste water disposal, Flocculation, Lagoons, Dams, Oil wastes, Hydrogen ion concentration, Biochemical oxygen demand, Activated sludge, *Water demand, Indiana, Water reuse, *Industrial wastes.
Identifiers: Burns Harbor, Clarifier.

A review is presented of the cost of steel production, the water required, and the resultant waste water treatment. Generally, water consumption in the modern steel plant varies from 35,000-45,000 gallons per ingot on produced. The type of process needed for production determines the amount of recirculation that can be performed which in turn causes variations in the amount of water needed and waste water produced. The water demand has necessitated construction of a 200 MGD pumping station. The waste treatment in steel production is complicated by the fact that integrated steel mills generally produce seven different types of waste water that all require different types of treatment. Burns Harbor will ultimately require that around 400 MGD be treated. Although waste treatment in steel plants is quite comprehensive, only three separate waste streams are described in this paper inasmuch as these are the facilities completed at this time. (Lowry-Texas)
W71-04080

PRETREATMENT OF TOXIC WASTES,
Bostock, Hill and Rigby, Birmingham (England).
R. K. Chalmers.
Water Pollution Control, Vol 69, No 3, p 281-291, 1970. 2 fig, 8 tab, 28 ref.

Descriptors: *Toxicity, *Waste treatment, Screening, Centrifugation, Filtration, *Recovery, Toxins, Evaporation, Sedimentation, Freezing, Solvent extractions, Ion exchange, Adsorption, Heavy metals, Industrial water, Industrial wastes, Industrial production, Water reuse, *Pre-treatment (Water), Effluents.
Identifiers: Swill waters, Metals recovery.

The author describes many of the chemical and physical treatment processes available and indicates there is much scientific progress in the field of waste treatment. He also indicates that scientific progress in this field will be tremendous in the last quarter of the 20th Century and very few problems in waste treatment will remain unsolved at the end of the century. Industry is applying considerable effort to modifying their processes so that they may reduce their effluent problems. Reduction of the amount of water needed for rinsing operations, recycle and reuse and using water for dual purposes are a few of the methods currently being used. Although there is much progress in waste treatment and industrial modifications much remains to be done in applying common sense to the reduction of water use and effluent problems at their source. (Lowry-Texas)
W71-04082

WASTE WATER RESULTING FROM THE CONCENTRATION OF LOW GRADE IRON ORE,
Michigan Technological Univ., Houghton. Dept. of Civil Engineering.
George R. Alger, C. Robert Baillod, and Henry S. Santeford.
Water and Sewage Works, Vol 117, No 10, p 359-362, October 1970. 5 fig, 3 tab, 5 ref.

Descriptors: *Iron, *Strip mines, *Re-circulated water, *Mine wastes, Waste dumps, Water purification, Settling basins, Ponding, Sedimentation, Waste water treatment, Impoundments, Tertiary treatment.
Identifiers: Lake Superior, Tailings deltas, Alum-coagulation, Tailings slurries.

The increasing scarcity of high-grade iron ore has necessitated the use of lower grade, or less concentrated ore pockets. This ore must then be concentrated to make it economical to process. The production of one tone of concentrate from four tons of crude ore requires from 600 to 6000 gallons of water, depending upon the method used. The waste water from this process contains 70,000 to 500,000 milligrams per liter of suspended solids, 90% of which settles very rapidly. Direct discharge of this waste water into a receiving stream or lake causes tailings deltas to build up. To prevent this, large impoundment basins are created, which allow the suspended solids to settle before the water gets to the receiving stream. Data shows that these systems must be carefully designed in accordance with prevailing weather conditions, and if so designed they will operate satisfactorily. Problems are most likely to occur during spring thaw, at which time alumcoagulation-sedimentation is used as a tertiary treatment measure. (Lowry-Texas)
W71-04083

ECONOMICS OF THERMAL POLLUTION CONTROL,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
George O. G. Lof, and J. C. Ward.
Journal Water Pollution Control Federation, Vol 42, No 12, p 2102-2116, December 1970. 5 fig, 3 tab, 16 ref.

Descriptors: *Economics, *Water temperature, *Thermal pollution, *Flow, *Cooling towers, Hydroelectric plants, Water cooling, Recirculated water, Specific heat, Cost analysis, Air temperature, Heat ransfer, Interest rate, Water pollution control.
Identifiers: Turbine-generator efficiency.

Approximately 80% of all water used by industry is used for cooling purposes and it has been estimated by the power industry that by 1980 10% of all the freshwater runoff in the U. S. will be used for cooling purposes. The economic consequences of thermal discharge from steam-electric power plants are modest increases in operating costs by the downstream users. Heat discharge prevention by recirculation is discussed. The reasons for recirculation are: (1) insufficient stream flow, (2) economic reasons, and (3) regulation by laws. The cost of cooling water recirculation is composed of: (1) capital costs (installation costs) which are dependent on the water flow required, the prevailing wet bulb temperature, the water temperature change through the tower, and the temperature of water delivery from the cooling tower to the condenser, and (2) operating costs which are dependent on the makeup of the water, chemicals required, and power for fans and pumps. Justification for temperature standards in streams cannot rest solely on the economics of cooling but it also depends on the ecology, aesthetic, and recreational use of the water. (Ellis-Texas)
W71-04084

KINETICS OF FIXED FILM BIOLOGICAL REACTORS,
Clemson Univ., S.C. Dept. of Environmental Systems Engineering.
B. H. Kornegay, and J. F. Andrews.
Industrial Waste Conference, 22nd, May 2, 3, 4, 1967, Purdue University, p 620-630, July 1968. 8 fig, 7 ref.

Descriptors: *Kinetics, *Trickling filters, *Filtration, Waste water treatment, Sewage treatment, Microorganisms, Mathematical models, Biological treatment.
Identifiers: Fixed-film, *Biological reactors, Substrate utilization, Substrate removal rate, Specific growth rate, Film thickness, Annular reactor.

An experiment was conducted in search of a more rational design procedure for trickling filters. Although the equations presented in this paper can not be construed to serve as mathematical approximations of the process of trickling filtration, the basic principles are the same, and the authors did a theoretical investigation of the kinetics of fixed-film, biological kinetics. Results of this experiment indicated that both dissolved oxygen and substrate utilization reached a steady-state value when the biological film thickness reached 70 microns and greater thickness resulted in no increase in the rate of removal. A theoretical substrate removal curve was developed and compared with the observed results of the completely-mixed, fixed-film reactor. This comparison showed: (1) the rate of removal shows a saturation phenomenon and by increasing the substrate concentration the rate of substrate removal approaches a constant value (2) the effluent concentration is dependent on the influent concentration and (3) the validity of the proposed model is supported by the agreement found between the theoretical curve and observed results. (Ellis-Texas)
W71-04085

BIOLOGICAL CHEMICAL COMBINATION DRAMATICALLY CUTS TREATMENT,
Teck Township (Ontario).
B. Davis, and S. Love.
Water and Pollution Control, p 35-37, May 1969. 3 fig.

Descriptors: *Waste water treatment, *Dissolved oxygen, *Biochemical oxygen demand, *Dissolved solids, Chemical oxygen demand, Hydrogen ion concentration, Coagulation, Chemicals, Aeration, Biodegradation, Sewage treatment.
Identifiers: Kirkland Lake, Ontario, Canada, Cyanide, Jar tests, Suspended solids, Total solids, Contact stabilization.

A very dilute municipal waste was observed and tested in studies conducted in Teck Township, Canada. It was found that the waste was not greatly effected by primary treatment so studies were un-

dertaken to establish the most efficient biological treatment process that would effectively treat the weak sewage. The results of the biodegradability study showed that a source of cyanide caused interference with biological systems and chemical coagulation studies were conducted to determine if this waste could be treated by this means. The chemical treatment resulted in improved BOD and suspended solids removals of 60% and 85%, respectively. It was decided to combine a biological system and chemical treatment. Using this combined treatment and adjusting the chemicals so that an optimum treatment was obtained, the BOD removal was 83% and suspended solids removal was 90%. The BOD of the treated effluent was consistently below 24 mg/l. The cost of the chemicals ranged from 2.0-2.5 cents/1000 gallons while retention time was reduced which would result in a reduction in capital costs. (Ellis-Texas)
W71-04086

SOLIDS SEPARATION BY ULTRAFILTRATION FOR CONCENTRATED ACTIVATED SLUDGE,
Syracuse Univ., N.Y. Bioenvironmental Engineering Div.
Frederick W. Hardt, Lenore S. Clesceri, Nelson L. Nemerow, and Donald R. Washington.
Journal Water Pollution Control Federation, Vol 42, No 12, p 2135-2148, December 1970. 11 fig, 5 tab, 17 ref.

Descriptors: *Filtration, *Activated sludge, Biochemical oxygen demand, Microorganisms, Membranes, Filters, Pressure, Hydrogen ion concentration, Chemical oxygen demand, Phosphorus, Respiration, Gels, Solvents, Solutes, *Waste water treatment.
Identifiers: Mixed liquor, Volatile suspended solids, *Ultrafiltration, Ultrafiltrate flux, Total organic carbon, Cell lysis.

An investigation of the feasibility of separating the suspended material from the mixed liquor and recyling this material back to the biological reactor as a means of treating high-BOD wastes was conducted. This involved passing feedwater at an elevated pressure across synthetic membranes where the larger dissolved solids and suspended material are retained by the membrane and recycled back through the activated sludge plant. Analytical methods included daily monitoring of the COD, total and orthophosphates, TOC, MLVSS, SS, inorganic solids, respiration rate, and the molecular size of the dissolved solids in the mixed liquor and the ultrafiltrate. This process showed a 98% COD reduction but had a gradual accumulation of cell degradation products in the biological reactor. The membranes used detained DS of molecular weights greater than 1000 which essentially removes all bacterial solids from the effluent stream. (Ellis-Texas)
W71-04087

METABOLIC RESPONSE OF ACTIVATED SLUDGE TO SODIUM PENTACHLOROPHENOL,
Oklahoma State Univ., Stillwater. School of Civil Engineering.
J. A. Heidman, D. F. Kincannon, and A. F. Gaudy, Jr.
Industrial Waste Conference, 22nd, May 2, 3, 4, 1967, Purdue University, Vol 52, No 3, p 661-647, July 1968. 8 fig, 1 tab, 13 ref.

Descriptors: *Activated sludge, *Metabolism, Acclimatization, Waste water treatment, Biological treatment, *Sludge treatment, Microorganisms, Chemical oxygen demand, Biochemical oxygen demand.
Identifiers: *Sodium pentachlorophenol, *Chlorinated hydrocarbons, Oxidative phosphorylation, Shock loadings, Oxygen uptake.

The effect of various concentrations of soidum pentachlorophenol (SPCP) on acclimated and non-acclimated sludges was investigated. Studies have shown that an activated sludge system can, with sufficient acclimation, be operated in the presence of SPCP concentrations up to 250 mg/l without serious retardation of biochemical purification efficiency. Biological solids in systems which were acclimated to SPCP were totally dispersed, and did not flocculate or settle during a one-hour settling period. The results obtained add evidence regarding release of metabolic products during the purification process and although SPCP did not exhibit a BOD, it caused glucose to exhibit a higher BOD during the aeration period. Under shock loading conditions it was seen that fairly small does of SPCP caused impairment of system efficiency. (Ellis-Texas)
W71-04088

CHEMICAL EXFOLIATED VERMICULITE FOR REMOVAL OF PHOSPHATE FROM WASTE WATERS,
Grace (W. R.) and Clarksville, Md.
Jacob Block.
Available from NTIS as PB-196 740, $0.95 in microfiche. For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. I 67.13/4: 17010 DHK 08/69 Paper Copy $0.50. Water Pollution Control Research Series 17010 DHK 08/69, August, 1969. 41 p, 5 fig, 12 tab, 6 ref. FWQA Program 17010 DHK Contract 14-12-485.

Descriptors: *Phosphates, *Waste water Treatment, *Aluminum, Iron, Effluents, Aluminum alloys, Chemical reactions, *Iron exchange.
Identifiers: *Phosphate Removal, *Vermiculities, Alumina.

The objective of the study was to prepare a chemically treated vermiculite with a high phosphate capacity that could be economically regenerated. Many aluminum vermiculites were prepared and tested for phosphate removal. 10 mg PO4/gram of treated vermiculite was the maximum capacity obtained. Highest phosphate capacities were obtained with materials prepared at relatively low pH (3.0) and dilute aluminum solutions (0.1-0.05M). Experimental results showed hydroxylated aluminum vermiculite is inactive towards phosphate ion. The mole ratio of phosphate adsorbed to exchanged aluminum seemed to approach 0.33, or an exchange capacity of 13.7 mg PO4/gm. The most successful regeneration scheme was one in which a dilute sulfuric acid solution containing a small amount of Al sub 2 (SO sub 4) sub 3 was used as a regenerant. Addition of the Al sub 2 (SO sub 4) sub 3 prevented the loss of aluminum from the vermiculite. No significant differences in capacity were found between thermally and chemically exfoliated vermiculite. Vermiculites containing cations other than Al were also prepared. These included Fe (III), Fe (II), La (III), and Cu (II). None appeared more promising than Al-vermiculite. The adsorption isotherm of aluminum-vermiculite was obtained, and the data were found to fit both the Langmuir and Freundlich plots. (Selby-Texas)
W71-04107

MEMBRANE MATERIALS FOR WASTE WATER RECLAMATION BY REVERSE OSMOSIS,
Gulf General Atomic, San Diego, Calif.
A. S. Douglas, M. Tagami, and C. E. Milstead.
Copy available from Sup Doc as $0.65; microfiche from NTIS as PB-197 448, $0.95. Water Pollution Control Research Series ORD-17040-EFO-06/70, June 1970. 64 p, 22 tab, 6 fig, 17 ref. FWQA Program 17040-EFO.

Descriptors: *Reverse osmosis, Semipermeable membranes, Demineralization, Membrane processes, *Osmosis, Tertiary treatment, *Waste water treatment, Water pollution control, *Water reuse, *Membranes, Sewage effluents.
Identifiers: Asymmetric membranes, Flux, Porous supports, Rejection.

An experimental program was carried out to evaluate potential reverse osmosis membranes for the tertiary treatment of secondary sewage effluent. The evaluation program consisted of both direct osmosis and reverse osmosis tests on various membranes using both single solutes and secondary effluent. The types of membranes tested were polyurethane latices, cellulose diacetate, cellulose 2.5-acetate, polyvinyl-pyrrolidone (PVP)-polyisocyanate interpolymers, and polyelectrolytes. The cellulose diacetate, polyurethane latices, and PVP membranes were not suitable for waste water treatment. Although rejection of most solutes by PVP membranes was quite good for dense, homogeneous membranes, high-flux, asymmetric membranes had poor rejection characteristics. Very-high-flux membranes were prepared from polyacrylic acid cast onto cellulose nitrate, cellulose nitrate-cellulose acetate, and polysulfone porous supports. While NaCl rejection of over 80% was obtained at fluxes of less than 20 gal/ft sq-day at 600 psi, increased flux was obtained only at the expense of good rejection. The best combination of high flux and rejection was obtained with asymmetric cellulose 2.5-acetate membranes heat-treated in water at 55 to 70C.
W71-04185

ENGINEERING FEASIBILITY DEMONSTRATION STUDY FOR MUSKEGON COUNTY, MICHIGAN, WASTE WATER TREATMENT-IRRIGATION SYSTEM.
Muskegon County Board, Mich. Dept. of Public Works.

Available from Sup Doc as I67:13/4:11010 FMY 10/70, $1.50; microfiche from NTIS as PB-197 447, $0.95. Water Pollution Control Research Series 11010 FMY 10/70, September 1970. 174 p, 37 tab, 28 fig, 331 ref. FWQA Program 11010 FMY.

Descriptors: *Oxidation lagoons, Groundwater management, Soil treatment, *Irrigation water, *Water reuse, *Waste water treatment, Michigan, Water pollution sources, Biochemical oxygen demand, Irrigation system, Domestic wastes, Industrial water, *Pulp wastes.
Identifiers: Muskegon County (Mich), Spray irrigation.

The feasibility of a lagoon treatment-spray irrigation system for the combined domestic wastes and industrial waste waters in Muskegon County, Michigan, was investigated in this study. The largest volume of industrial waste waters are those discharged by a pulp and paper mill. Various aspects of the project were investigated including: (1) sampling and analyses of waste waters for a variety of parameters, (2) a review of available information concerning the effect of trace elements on soils and crops, (3) laboratory tests of the treatability of the combined waste waters by lagoon treatment, (4) development of a simulation model to assist in analyzing the volume and water quality aspects of a treated waste water storage lagoon, (5) soils and groundwater field and office studies regarding the management of groundwater levels to ensure an adequate aerobic treatment zone in the soil as well as to prevent ponding in the site area, and (6) investigations of certain agricultural aspects in using treated waste waters as spray irrigation water. The results of this work demonstrated the feasibility of the proposed project based on information developed during the study, the highlights of which are: (1) the waste waters do not contain constituents having concentrations that would interfere with use of these waste waters as agricultural irrigation waters, (2) the treatability of the wastes by the proposed lagoon treatment system was confirmed by the laboratory work, and (3) the feasibility of management of the groundwater levels within the irrigation site area by drainage wells and tile was established by the investigations. (See also W69-09331)
W71-04186

TREATMENT OF ACID MINE DRAINAGE BY FOAM SEPARATION,
Horizons, Inc, Cleveland, Ohio.
J. J. Bikerman, P. J. Hanson, and S. H. Rose.

Copy available from Sup Doc as I67:13/4:14010 DEE 12/70, $1.00; microfiche from NTIS as PB-197 470, $0.95. Water Pollution Control Research Series, 14010 DEE 12/70, Federal Water Quality Administration, Washington, D.C., December 1970. 88 p, 11 tab, 10 fig, 19 ref, 4 append. FWQA Program 14010 DEE.

Descriptors: *Foam separation, Mine wastes, Iron, Calcium, Magnesium, *Surfactants, Water purification, *Acid mine water, *Waste water treatment, *Mine drainage, *Coal mine wastes, Costs, Ions.

Basic experiments were conducted to establish the feasibility of foam fractionation in the treatment of acid coal mine drainage for the removal of the metal ions iron, calcium, manganese and magnesium. The independent variables controlling foam separation of metal ions were determined to be the concentration ratio of surfactant to iron, the air volume throughput, the foam drainage time, the total dissolved salt content and the type of surfactant used. The major part of iron, calcium, manganese and magnesium can be foam separated from acid solution by proper control of the independent variables. Reduction of residual surfactant concentration in the treated water and reduction of water entrained with the foam are two areas in need of further investigation. Foam separation was tested on acid drainage, partially lime neutralized drainage and complete limestone neutralized drainage. Tests on model solutions indicate that treatment of raw acid drainage is most feasible at present. Operating and capital costs are estimated for 0.1 and 1.0 MGD batch treatment plants.
W71-04188

NEUTRALIZATION OF HIGH FERRIC IRON ACID MINE DRAINAGE,
Robert A. Taft Water Research Center, Cincinnati, Ohio.
Roger C. Wilmoth, and Ronald D. Hill.
Copy available from Sup Doc as I67:13/4:14010 ETV 08/70, $0.50; microfiche from NTIS as PB-197 471, $0.95. Water Pollution Control Series 14010 ETV 08/70, August 1970. 38 p, 18 tab, 8 fig, 9 ref. FWQA Program 14010 ETV.

Descriptors: Water Pollution Control, Acid streams, *Neutralization, Lime, Limestone, *Waste water treatment iron compounds, Hydrogen ion concentration, *Mine drainage, *Acid mine water, *Ion, Aeration.
Identifiers: Soda ash.

Lime, limestone, and soda ash were studied as neutralizing agents for treatment of a ferric iron acid mine drainage water. Both continuous flow and batch tests were used to determine the effectiveness of each of these neutralizing agents in reaction with acid mine water. Comparisons made between the three neutralizing agents include: chemical costs, reaction efficiencies, effluent water qualities, sludge settling rates, sludge volumes, and percent solids of sludges. All three neutralizing agents were capable of treating acid mine drainage. Lime costs were half that of limestone for treating the same acid mine drainage because of the low utilization of limestone. However, the characteristics of the limestone sludge were superior to those of lime and soda ash sludges. The cost for soda ash treatment was excessive. Further research on improving limestone utilization is under way. No differences in reaction efficiency were found in dry feeding or slurry feeding the neutralizing agents. Aeration during and/or after the limestone reaction merely increased the effluent pH but failed to increase limestone useage efficiency or improve effluent quality.
W71-04189

MINERAL RECOVERY FROM CONCENTRATED BRINES,
Brigham Young Univ., Provo, Utah.
For primary bibliographic entry see Field 02K.
W71-04223

ECONOMIC FEASIBILITY OF SELECTIVE ADJUSTMENT IN USE OF SALVAGEABLE WATERS IN THE TUCSON REGION, ARIZONA,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
Kenneth James DeCook.
PhD Thesis, University of Arizona, 1970. 216 p, 10 fig, 27 tab, 75 ref. OWRR Project A-020-ARIZ (1).

Descriptors: *Water reuse, Salvage value, Recreation, Irrigation, *Costs, Model studies, Waste water treatment, Sewage treatment, Treatment facilities, Arizona, Water Quality Act.
Identifiers: *Tucson, Santa Cruz River, Pima County.

This thesis anlayzes the economic feasibility of using salvageable water from domestic-industrial effluents, as well as from storm runoffs for recreational, industrial and agricultural purposes in the Tucson area. The author determines the costs associated with the utilization of these waters and the benefits to be derived from each kind of use. He combines these net-benefit coefficients into a simple normative model which can be used for examining specific planning and operational adjustments in the regional salvageable water system. In the Tucson area the author concludes that the demand for water for recreational uses would support the construction of new sewage treatment facilities. (Holmes-Rutgers)
W71-04269

INDUSTRIAL WASTE DESALTING FOR BYPRODUCT RECOVERY,
Office of Saline Water, Washington, D.C.
Eric D. Bovet.
Journal American Water Works Association, Vol 62, No 9, September 1970, p 539-542. 10 tab.

Descriptors: *Demineralization, *Desalination, *Byproducts, Economics, Electro-osmosis, Reverse osmosis, Tertiary treatment, Waste treatment, Waste water treatment, Pollution abatement, Abatement.
Identifiers: *Desalting, *Byproduct recovery, Cheese wastes, Pulp and paper wastes, Iron and steel wastes, Plating and metal finishing wastes, Nuclear wastes, Coal mine wastes.

Desalting of industrial wastes is not a complete solution to the problem of their disposal, but it is of value of reducing the pollutional load on rivers and lakes. Desalting may be economically feasible when a salable byproduct is produced by the process. It has been estimated that a one-time market of $1.5 billion exists for desalting equipment between 1970 and 1990. Industries in which desalting may yield a profitable byproduct include, but are not limited to, the Cheese, Pulp and paper, Iron and steel, Plating and metal finishing, Nuclear power and Coal mining industries. Other large industries in which desalting may be profitable are the chemical and petroleum industries. The time is fast approaching when the profitability of desalting will be secondary to the need for reducing the pollution load on the environment. When this happens the market for desalting equipment will widen greatly. (Hewett-Rutgers)
W71-04286

5E. Ultimate Disposal of Wastes

EFFECTS OF WASTE DISPOSAL INTO MARINE WATERS - A SURVEY OF STUDIES CARRIED OUT IN THE LAST TEN YEARS,
Engineering-Science, Inc., Arcadia, Calif.
For primary bibliographic entry see Field 05C.
W71-04114

5F. Water Treatment and Quality Alteration

STREAM QUALITY MODELING BY QUASILINEARIZATION,
Kansas State Univ., Manhattan. Dept. of Industrial Engineering.
E. S. Lee, and Irving Hwang.
In: Modeling and Optimization of Water Resources Systems Phase I, Kansas State Univ, Appendix B4, (1970). 28 p, 2 fig, 8 tab, 6 ref.

Descriptors: *Mathematical modeling, *Stream improvement, *Water quality control, Least squares method, Constraints.
Identifiers: *Quasilinearization, Parameters, Differential equations.

A fairly effective technique for estimating parameters or coefficients in differential equations arising in stream quality modeling was introduced. The parameter estimation problem was treated as a two-point or multipoint boundary-valve problem by the quasilinearization technique. To illustrate the approach, a simple representation of stream quality which included BOD concentration, DO deficit and other physical constraints was considered. First, only three data points were used to estimate the rate constants. Then the case was shown where more than three data points were desirable to obtain and the classical least squares criterion was used so that the sum of the squares of the deviations was minimized. A generalized system of nonlinear differential equations was used to apply the quasilinearization technique and its computational procedure was shown. To test the effectiveness of the approach, given data were obtained numerically by solving two equations. Estimation of two parameters was shown as well as estimation of experimental errors, and estimation of three parameters. It was shown that with very approximate initial guesses for the unknown parameters, only three to five iterations were needed to obtain 4 to 5 digit accuracy. (See also W71-04043) (Kriss-Cornell)
W71-04045

5G. Water Quality Control

SYSTEMS ANALYSIS FOR WATER SUPPLY AND POLLUTION CONTROL,
Michigan Univ., Ann Arbor. School of Public Health.
For primary bibliographic entry see Field 06A.
W71-03857

A QUANTITATIVE FRAMEWORK FOR RESIDUALS--ENVIRONMENTAL QUALITY MANAGEMENT,
Resources for the Future, Inc., Washington, D.C.
Clifford S. Russel, and Walter O. Spofford.
In: Natural Resource Systems Models in Decision Making, Water Resources Research Center, Purdue Univ, p 66-86, 1970. 21 p, 4 fig, 1 tab.

Descriptors: *Optimization, *Mathematical models, *Linear programming, Diffusion, Damages, Quality control, Management.
Identifiers: *Non-linear programming, Residuals.

A conceptual framework for a large scale, regional environmental quality management model was discussed. The model was designed first to deal explicitly with the major forms of residuals--airborne, waterborne and solid wastes, and noise. It allowed physical tradeoffs among these in production and treatment. Secondly, it reflected possibilities of substitution within production processes. The model was divided into three parts: (I) a linear inter-industry model; (II) a set of environmental diffusion models; and (III) a set of receptor damage functions. The model aimed at an optimal selection of residual discharge levels from the production activities of a region. The computational procedure

involved non-linear programming techniques. The result of this computation was residual discharge vector. In order to test the quantitative procedure a didactic version of the model using a hypothetical region was used which consisted of a single river, two urban areas--an industrial area and a residential area, and miscellaneous activities. Two economic activities were analyzed: a beet sugar processing plant and a thermal power generating facility. This model could be used to explore solution sensitivity to the parameters of physical models and damage functions. (See also W71-03855) (Kriss-Cornell)
W71-03858

THE INCIDENCE AND FORMATION OF MINE DRAINAGE POLLUTION - APPENDIX C TO 'REPORT FOR DEVELOPMENT OF WATER RESOURCES OF APPALACHIA'.
Corps of Engineers, Cincinnati, Ohio. Office of Appalachian Studies.
For primary bibliographic entry see Field 05B.
W71-03872

STREAM POLLUTION BY COAL MINE DRAINAGE IN APPALACHIA.
Federal Water Quality Administration, Cincinnati, Ohio.
For primary bibliographic entry see Field 05B.
W71-03873

A REVIEW OF CURRENT RESEARCH ON COAL MINE DRAINAGE IN APPALACHIA,
Bureau of Mines, Pittsburgh, Pa. Area 1 Mineral Resources Office.
For primary bibliographic entry see Field 05B.
W71-03874

FACTORS THAT AFFECT THE FORMATION OF COAL MINE DRAINAGE POLLUTION IN APPALACHIA,
Bureau of Mines, Pittsburgh, Pa. Area 1 Mineral Resource Office.
For primary bibliographic entry see Field 05B.
W71-03875

THE OXIDATION OF PYRITE ASSOCIATED WITH COAL MINES,
Bureau of Mines, Pittsburgh, Pa. Area 1 Mineral Resource Office.
For primary bibliographic entry see Field 05B.
W71-03876

SURVEY OF COSTS ON METHODS FOR CONTROL OF ACID MINE DRAINAGE POLLUTION,
Bureau of Mines, Pittsburgh, Pa. Area 1 Mineral Resource Office.
For primary bibliographic entry see Field 05B.
W71-03877

A REVIEW OF THE 1969 LITERATURE ON WASTE WATER AND WATER POLLUTION CONTROL, ADMINISTRATION: SYSTEMS ANALYSIS,
Cornell Univ., Ithaca, N.Y.
Daniel P. Loucks.
Journal Water Pollution Control Federation, Vol 42, No 6, p 1112-1119, June 1970. 8 p, 103 ref.

Descriptors: *Systems analysis, *Waste water treatment, *Water pollution control, *Model studies, Economics, Political aspects, Stochastic processes, Application methods.

Literature on waste water and water pollution control for 1969, specifically pertaining to systems analysis, was reviewed. Articles reviewed included: systems analysis application to water supply and waste water disposal problems by Harrington; political influence on public policy in regional water quality models by Dorfman, Jacoby, and Loucks; economic models for regional water quality planning by several authors; systematic approach to minimum cost and salinity control in a river described by Coffey and Ortolano and others using alternate methods; river aeration problems by Davidson and Tarassov; thermal and organic wastes considered by Dysart and Hines; stochastic BOD and DO models for rivers developed by Custer and Drutchkoff; Boyd's examination of relation between pollution, income, and costs of augmenting waste assimilative capacity; flow augmentation benefits by Pyatt, et al; the 1961 Delaware Estuary study; Orlob's technique for representing the complex hydrodynamic behavior of estuarial environments; systems analysis of waste water treatment design and operation; models for activated sludge; systems analysis applied to waste water treatment design and unit process design by Galler; and effluent storage models studied by Sobel and Phillips, et al. Has 103 references. (Kriss-Cornell)
W71-03879

SYSTEM OPTIMIZATION FOR RIVER BASIN WATER QUALITY MANAGEMENT,
Weston (Roy F.), Inc., West Chester, Pa.
Chia Shun Shih.
Journal Water Pollution Control Federation, Vol 42, No 10, p 1792-1804, Oct 1970. 13 p, 7 fig, 9 tab, 11 ref.

Descriptors: *Optimization, *Dynamic programming, *Model studies, *Water quality control, *Water management (Applied), Pollutants, Costs, Waste treatment, River basin.

A dynamic programming model was presented that minimized the total costs to water users and waste dischargers in a basin. The model could also identify direct benefits in terms of reduced treatment costs. The optimization criterion was to minimize total water supply and waste treatment costs and to maximize the direct benefits for the basin subject to regulatory agency constraints. The river basin model included both conservative and nonconservative pollutants in its optimization scheme yet nonconservative pollutant effects were emphasized. The optimization procedure was illustrated by a simplified example. The hypothetical cost functions used in the examples were compiled from past experience and various literature sources; the basic data were generalized for inclusion in the example. In formulating the model a hypothetical river system was developed. The most salient features associated with the application of the model presented were discussed. (Kriss-Cornell)
W71-03881

MATHEMATICAL MODELS AS AN AID IN THE SOLUTION OF WATER POLLUTION CONTROL PROBLEMS,
Water Pollution Research Lab., Stevenage (England).
G. Knowles.
Chemistry and Industry, p 697-701, May 1970. 5 p, 5 fig, 6 ref.

Descriptors: *Mathematical models, *Water pollution control, *Computers, Activated sludge, Nitrification, Esturaries, Biochemical oxygen demand, Dissolved oxygen.

Some recent applications of mathematical models in water pollution control, including a brief discussion of types of computers suitable for such work, were described. First, the design of activated sludge plants to obtain nitrification was dealt with. Due to lack of adequate methods involving population dynamics, such models have not overcome many problems. Research has been conducted though exploring its basic mechanisms. One such mathematical model dealing with minimum period of retention of the waste water in an aeration tank for consistent nitrification was presented. Second, an example of a mathematical model used to aid in the management of estuaries which neglected tidal motion so that the water was regarded as always being at half tidal level was given. Next, a mathematical model was developed for predicting biochemical oxygen demand values in an estuary and the example used was an estuary on the South Coast of England. A model for predicting dissolved oxygen values in an estuary was presented last with an application to the Thames Estuary. General purpose digital computers, analogue computers, and hybrid computers were cited as those used for mathematical models. (Kriss-Cornell)
W71-03884

A LONG-TERM PLAN FOR SEWERAGE DEVELOPMENT IN THE JOHANNESBURG REGION,
Johannesburg City Engineer's Dept. (South Africa).
V. Bolitho.
Water Pollution Control, Vol 69, No 1, p 79-91, 1970. 6 fig, 3 tab, 8 ref.

Descriptors: *Sewers, *Sewage disposal, *Sewerage, Sewage, Pipelines, Pumping plants, Urbanization, Environmental sanitation, Water pollution control.
Identifiers: Johannesburg (South Africa).

The scope of the Johannesburg waste water scheme and its future are dealt with in this paper. Adequate sanitation has been an essential prerequisite of urbanization and population predictions in this city indicate a sanitation problem. The sustained rate of increase in sewage flows has been approximately 6 1/2% per year compounded and if this rate continues the quantities to be handled will double in 10-12 years meaning the same amount of sewerage and treatment facilities will have to be built in that time as have been built in the past 60 years. Possible advancements in the technology of sewage treatment and progressive planning in sewerage systems and designs may alleviate some of the burden caused by the increasing population. (Ellis-Texas)
W71-03895

MINE WASTE WATER PROBLEMS IN EUROPE,
Pennsylvania Dept. of Mines and Mineral Industries, Harrisburg.
For primary bibliographic entry see Field 05D.
W71-03898

A COMPREHENSIVE WATER QUALITY CONTROL PROGRAM FOR THE LAS VEGAS WASH DRAINAGE BASIN. PHASE I.
Boyle Engineering, Las Vegas, Nev.; and Cornell, Howland, Hayes, and Merryfield, Las Vegas, Nev.
For primary bibliographic entry see Field 05D.
W71-03901

A COMPREHENSIVE WATER QUALITY CONTROL PROGRAM FOR THE LAS VEGAS WASH DRAINAGE BASIN.
Boyle Engineering, Las Vegas, Nev.; and Cornell, Howland, Hayes, and Merryfield, Las Vegas, Nev.
For primary bibliographic entry see Field 05D.
W71-03902

APPLICATION OF INDUSTRIAL DYNAMICS CONCEPTS TO DECISION MAKING IN ENVIRONMENTAL MANAGEMENT,
Engineering Science, Inc., Oakland, Calif.; and General Behavioral Systems, Los Angeles, Calif.
W. E. Gates, R. M. Males, and J. F. Walker.
Water Resources Research, Vol 6, No 6, p 1549-1558, December 1970. 10 p, 5 fig, 3 ref, 1 append.

Descriptors: *Simulation model, *Dynamics, *Decision making, *Water quality control, *Regional analysis, Environmental engineering, California.
Identifiers: Feedback loop.

Dynamic feedback modeling of decision making process of a California regional water quality board was carried out to study the interactions of the board with various groups having different vested interests in water quality and the impact of these interactions on achieved water quality. Specific applications of the concepts of industrial dynamics to environmental systems, termed environmental system dynamics (ESD), was used to develop the model of regional board decision making. California was divided into nine regions for the purpose of water quality management and each region appointed a regional board with associated staff and executive officer (the extended board). The decision making process was formulated as a continuous interaction and interplay between the components of the extended board and specific interest groups. The feedback loop structure used was divided into five functional areas: generation, desired quality, perceived quality, negotiation, and response. The model was structured and tested for the situation of two distinct interest groups: an industrial waste discharger and a conservation group maintaining opposing positions to an existing discharge. The model was useful for exploration of the implications of alternative institutional arrangements. (Kriss-Cornell)
W71-04025

MATHEMATICAL PROGRAMMING APPLICATIONS TO WATER QUALITY PLANNING FOR THE BOSTON HARBOR REGION,
Massachusetts Inst. of Tech., Cambridge. Urban Systems Lab.
John C. Schaake, Jr.
Report, TR-70-33 (1970). 75 p, 14 fig, 17 tab, 17 ref.

Descriptors: *Mathematical models, *Linear programming, *Water quality control, *Planning, Waste treatment, Estuaries.
Identifiers: *Boston Harbor, Differential equations, Uncertainty.

A case study of water quality planning for the Boston Harbor, in which mathematical programming techniques were applied to seek the best alternatives for investing in water pollution control facilities in order to meet target water quality criteria, was described. The control alternatives included (a) waste treatment; (b) transmission of treated or untreated wastes to disposal sites anywhere in the harbor or surrounding area; and (c) storage of combined sewerage overflows. In order to supply information to the model about the response of the physical system to the inputs of wastes at different locations, basic differential equations governing the movement of water and wastes in two-dimensional tidal estuaries were solved. These equations were linear but with time varying coefficients. The technique for solving these equations permitted the harbor to be divided into irregularly shaped segments rather than a uniform grid of regularly spaced rectangular segments. The model was operated for three assumed conditions to show the sensitivity of decisions to uncertainty in the available data. The first run was a base run; the second run tested the effect of uncertainty in costs of waste treatment; the third run tested the effect of rigid water quality constraint levels. (Kriss-Cornell)
W71-04036

A WATER-QUALITY SIMULATION MODEL FOR WELL-MIXED ESTUARIES AND COASTAL SEAS: VOLUME I, PRINCIPLES OF COMPUTATION,
Rand Corp., Santa Monica, Calif.
For primary bibliographic entry see Field 06A.
W71-04038

ACTIVITIES OF THE FEDERAL WATER POLLUTION CONTROL ADMINISTRATION--WATER QUALITY STANDARDS.
For primary bibliographic entry see Field 06E.
W71-04096

WATER QUALITY CONTROL: A MODERN APPROACH TO STATE REGULATION,
For primary bibliographic entry see Field 06E.
W71-04101

FEDERAL ENFORCEMENT UNDER THE REFUSE ACT OF 1899,
For primary bibliographic entry see Field 06E.
W71-04102

FEASIBILITY STUDY OF MINING COAL IN AN OXYGEN FREE ATMOSPHERE.
Island Creek Coal Co., Holden, W. Va. Island Creek Div; and NUS Corp., Pittsburgh, Pa. Cyrus Wm. Rice Div.

Copy available from Superintendent of Documents as I67:13/4:14010 DZM 08/70, $1.50; microfiche from NTIS as PB-197 446, $0.95. Water Pollution Control Research Series 14010 DZM 08/70, August, 1970. 163 p, 13 tab, 21 fig, 20 ref. FWQA Program 14010 DZM.

Descriptors: *Acid mine water, Mining, *Mining engineering, Health, Safety, Communication systems, Data acquisition, *Mine drainage, *Coal mines, Methane, Oxygen.
Identifiers: Inert gas, Life support systems.

A systems evaluation was made to determine the engineering feasibility and probable economics of mining coal in an active deep mine in an oxygen free atmosphere using current technology in the application of life support systems to conventional coal mining techniques. The project was Phase I of a four phase program to demonstrate that mining coal in an oxygen free atmosphere will prevent the formation of acid mine water. Other major benefits include improved working conditions from a health and safety standpoint. A detailed investigation was conducted into the application and suitability of commercially available inert gas generators, life support clothing and equipment, and personnel communications systems. Three sites were investigated for a demonstration mine. The investigation revealed it is feasible from an engineering standpoint to mine coal in an oxygen free atmosphere. Life support and associated equipment are available essentially off-the-shelf. A deep mine using conventional mining equipment can be designed to operate in an oxygen free atmosphere. The comparative economics are extremely favorable when methane gas is recovered and sold.
W71-04187

TREATMENT OF ACID MINE DRAINAGE BY FOAM SEPARATION,
Horizons, Inc, Cleveland, Ohio.
For primary bibliographic entry see Field 05D.
W71-04188

NEUTRALIZATION OF HIGH FERRIC IRON ACID MINE DRAINAGE,
Robert A. Taft Water Research Center, Cincinnati, Ohio.
For primary bibliographic entry see Field 05D.
W71-04189

PROCEEDINGS: CONFERENCE ON POLLUTION OF LAKE MICHIGAN AND ITS TRIBUTARY BASIN, ILLINOIS, INDIANA, MICHIGAN, AND WISCONSIN.

Federal Water Pollution Control Admin, Vol 1, (1969). 363 p.

Descriptors: *Lake Michigan, *Administration, *Programs, *Pollution abatement, Michigan, Indiana, Illinois, Water quality control, Legislation, Wastes, Water pollution, Regulation, Municipal wastes, Industrial wastes, Pesticides, Boats, Federal government, State governments, Planning, Project planning, Projects, Oil wastes, Water pollution sources, Water analysis, Water pollution control.

In these proceedings of the Conference on Pollution of Lake Michigan and its Tributary Basin, reports are given by the Army Corps of Engineers and the states of Michigan, Indiana and Illinois. The reports set forth steps taken to implement a program previously established by the Conference. That program includes recommendations covering industrial wastes, dumping of polluted materials, wastes from watercraft, pesticides, oil spills and water quality analysis. Reports consist of progress made by agencies charged with implementing the program in the various states, the extent of compliance with standards by the industries, municipalities and individuals affected, and ordinances and legislation passed to effectuate the Conference recommendations. (Douberley-Florida)
W71-04256

CITY OF SALEM V HARDING (CITY'S NEGLIGENCE IN CAUSING ILLNESS BY CONTAMINATION OF WATER SUPPLY).
For primary bibliographic entry see Field 06E.
W71-04278

POLLUTION PROBLEMS, RESOURCE POLICY AND THE SCIENTIST,
New York State Coll. of Agriculture, Ithaca. Dept. of Conservation.
For primary bibliographic entry see Field 06B.
W71-04280

OFFSHORE OIL SPILLS: AN EVALUATION OF RECENT UNITED STATES RESPONSES,
For primary bibliographic entry see Field 06E.
W71-04305

PEOPLE V PORT OF NEW YORK AUTHORITY (REMEDY FOR POLLUTION OF STATE PROPERTY).
For primary bibliographic entry see Field 06E.
W71-04311

REORGANIZATION PLAN NO. 3 OF 1970 (ENVIRONMENTAL PROTECTION AGENCY).
For primary bibliographic entry see Field 06E.
W71-04325

REORGANIZATION PLANS NOS. 3 AND 4 OF 1970.
For primary bibliographic entry see Field 06E.
W71-04326

RULES OF PRACTICE AND PROCEDURE.
Delaware River Basin Commission, Trenton, N.J.
For primary bibliographic entry see Field 06E.
W71-04327

STATE WATER CONTROL LAW.
Virginia State Water Control Board, Richmond.
For primary bibliographic entry see Field 06E.
W71-04335

OUTLINE -- ENFORCEMENT OF 1899 REFUSE ACT THROUGH CITIZEN ACTION.
For primary bibliographic entry see Field 06E.
W71-04336

CHESAPEAKE BAY IN LEGAL PERSPECTIVE,
Maryland Univ., Baltimore. School of Law.
For primary bibliographic entry see Field 06E.
W71-04337

06. WATER RESOURCES PLANNING

6A. Techniques of Planning

NATURAL RESOURCE SYSTEMS MODELS IN DECISION MAKING.
Purdue Univ., Lafayette, Ind. Water Resources Research Center.

Available from NTIS as PB-197 111, $3.00 in paper copy, $0.95 in microfiche. Proceedings of a Water Resources 1969 Seminar, Water Resources Research Center, Purdue University, Lafayette, Indiana, 1970. 245 p. Gerrit H. Toebes, (editor). OWRR Project A-999-IND (4).

Descriptors: *Natural Resources, Water resources, *Decision making, Cost allocation, *Economics, *Planning, Social aspects, *Systems analysis, Optimum development plans, Political systems, Political constraints, Non-structural alternatives, Air pollution, Costs, Operations research, California.
Identifiers: Oswego Basin (Calif), West Basin (Calif).

The text of the publication is based on a series of lectures given for the 1969 water resources seminar at Purdue University. The invited speakers were asked to present their material on a selected theme in an introductory manner with discussion following the formal presentation. The dialogues which ensued in the seminar are not given; however, the lectures are presented in the publication. The first paper is a concise introduction to systems analysis in natural resources management and its relation to the decision making process. The subsequent chapters are arranged according to a visualized hierarchy of systems. The emphasis on the papers II through VII is on the physical system and questions about its modeling, optimization and output evaluation. The papers VIII and IX take up questions in the economic system that is regarded as the environment of the physical system. The papers X through XIII emphasize components in the legal-political system representing the environment of the economic system. Taken together, the material makes for meaningful supplementary reading to the more formal course work in natural resource systems analysis that students are electing in increasing number. (See also W71-03856 thru W71-03868)
W71-03855

RESOURCE SYSTEMS MODELS IN DECISION MAKING,
Purdue Univ., Lafayette, Ind. School of Civil Engineering.
Gerrit H. Toebes.
In: Natural Resource Systems Models in Decision Making, Lafayette, Indiana. Water Resources Research Center, Purdue, University, p 1-44, 1970. 24 fig, 4 tab.

Descriptors: *Decision making, *Model studies, *Systems analysis, *Analytic techniques, Ecology, Administration, Political aspects, Optimization, Management.
Identifiers: *Resource systems.

Resources systems models in decision making and their evolution are set forth in an introductory manner. A liberal use of graphics is made to illustrate the various generic terms in common use; and the operational role of systems analysis in ecological, administrative, and political concerns with water resources use, is noted and portrayed diagrammetrically. Basic systems concepts and systems morphology are defined. Systems synthesis and systems optimization are seen as rather separate activities. A hierarchy of systems is defined and taken as a starting point for model synthesis and decomposition of systems models into functions. A brief introduction to systems analysis techniques is followed by a short discussion of systems evaluation. Finally, the significance of the systems approach to actual decision making in natural resource development and management is considered. (See also W71-03855) (Davis-Chicago)
W71-03856

SYSTEMS ANALYSIS FOR WATER SUPPLY AND POLLUTION CONTROL,
Michigan Univ., Ann Arbor. School of Public Health.
Rolf A. Deininger.
In: Natural Resources Systems Models in Decision Making, Water Resources Research Center, Purdue Univ, p 45-65, 1970. 21 p, 11 fig, 9 ref.

Descriptors: *Systems analysis, *Planning, *Water supply, *Pollution abatement, Sewage treatment, Waste water treatment.

The purpose of this paper was to review the role of systems analysis in the planning of water supply systems and pollution control works. Six examples were briefly outlined which showed the use of new techniques on practically every level of pollution control and water supply engineering. First, the standard steps in a systems analysis study were shown as well as the techniques and tools available for use. These included linear and dynamic programming, digital computer, simulation techniques, etc. The specific examples used to illustrate the use of these techniques were entitled; (a) design of a sewer system; (b) design of sewage treatment plants; (c) design of intercommunity waste water collection and treatment systems; (d) river basin-wide planning; (e) conversational design of treatment plants and automatic plotting of plans and (f) a water supply problem pertaining to the city of Ankara, Turkey. (See also W71-03855) (Kriss-Cornell)
W71-03857

A QUANTITATIVE FRAMEWORK FOR RESIDUALS--ENVIRONMENTAL QUALITY MANAGEMENT,
Resources for the Future, Inc., Washington, D.C.
For primary bibliographic entry see Field 05G.
W71-03858

THE EVALUATION OF THE COST OF ALTERNATIVE STRATEGIES FOR AIR POLLUTION CONTROL,
Temple Univ., Philadelphia, Pa. Dept. of Economics.
Azriel Teller, and J. R. Norsworthy.
In: Natural Resource Systems Models in Decision Making, Water Resources Research Center, Purdue Univ, p 87-99, 1970. 13 p, 4 fig, 3 tab, 13 ref.

Descriptors: *Mathematical models, *Linear programming, *Simulation analysis, *Optimization, Air pollution, Quality control, Costs.

Some current work in developing models to evaluate alternative strategies for air resource management was outlined. The social objective was the minimization of the total cost of air pollution to society subject to varying institutional constraints. Two basic models were developed. One, the linear programming model used in conjunction with meteorological transport coefficients, permitted the design of an economically efficient system of air pollution control. In order to achieve higher air quality for a given dollar outlay, or to lower the cost of achieving a given air quality standard, selective, instead of uniform abatement and intermittent abatement based on forecasting meteorological conditions, rather than continuous abatement, were used. The more general simulation program described not only optimized the model but permitted consideration of non-linear functions as well as limited management of the time-phased abatement investment decision problem facing industries. By adjusting parameters in the simulation program, the sensitivity of the optimal abatement plan design to uncertainty in cost, meteorological, and other data was determined. A method for estimating the cost of satisfying a sequence of quality standards over several years was discussed. (See also W71-03855) (Kriss-Cornell)
W71-03859

PLANNING FOR THE OSWEGO BASIN IN NEW YORK--A SYSTEMS APPROACH,
New York State Div. of Water Resources, Albany.
Allen C. Tedrow.
In: Natural Resource Systems Models in Decision Making, Water Resources Research Center, Purdue Univ, p 100-114, 1970. 15 p, 11 fig.

Descriptors: *Simulation analysis, *Systems analysis, *Optimization, *Reservoir operation, *Mathematical models, Cost-benefit analysis, Lakes, Canals, Flood control, New York.
Identifiers: Oswego Basin.

A simulation model, used to seek an optimal operating policy and to do planning for new works for the Oswego Basin in New York, was developed according to the basic objectives of the New York State Division of Water Resources. These basic objectives were that (a) the plan should be multipurpose; (b) the plan should be comprehensive; and (c) affected parties may participate in decision making. The Oswego Basin has a drainage area of some 5,100 sq. miles and contains 9 major lakes, six of which are under local control, the other three comprising a reservoir-canal system under state management. Finding better management and regulation plans for the existing reservoir system was the problem to be solved. To define the system, two simulation models--one for flooding and one for budgeting monthly flows, were developed. The model consisted of some 50 nodes and some 30 unit hydrograph inputs. It was subdivided into the following sectors: (a) flood damage, (b) conservation, (c) quality, (d) supplementary irrigation, (e) water supply, (f) navigation, (g) recreation (including boating), and (h) fish and game. The flood simulation sector had a time scale considerably less than the monthly scale of the other sectors. In the studies outlined, the primary measurement criteria was net costs and benefits as best they could be identified. (See also W71-03855) (Kriss-Cornell)
W71-03860

WATER RESOURCES PLANNING IN THE URBAN-METROPOLITAN CONTEXT,
North Carolina Univ., Chapel Hill. Dept. of City and Regional Planning.
For primary bibliographic entry see Field 06B.
W71-03861

INCORPORATING SOCIAL OBJECTIVES IN SYSTEMS MODELS,
Kentucky Univ., Lexington. Dept. of Civil Engineering.
For primary bibliographic entry see Field 06B.
W71-03862

PRIVATE AND SOCIAL COSTING AND PRICING AS DECISION DETERMINANTS,
Ohio State Univ., Columbus. Dept. of Economics.
For primary bibliographic entry see Field 06C.
W71-03863

PRIVATE AND SOCIAL COSTING AS DECISION DETERMINANTS IN WATER RESOURCES,
Rutgers-The State Univ., New Brunswick, N.J. Water Resources Research Inst.
For primary bibliographic entry see Field 06B.
W71-03864

THE LEGAL SYSTEM: STRUCTURE OR CONSTRAINT FOR SYSTEMS ANALYSIS DECISION-MAKING,
Indiana Univ., Bloomington. School of Law.
For primary bibliographic entry see Field 06E.

W71-03865

CONDITIONS OF LEGAL AND POLITICAL FEASIBILITY,
Indiana Univ., Bloomington. Dept. of Political Science.
For primary bibliographic entry see Field 06E.
W71-03866

INSTITUTIONAL DESIGN FOR WATER QUALITY MANAGEMENT: THE IMPLICATIONS OF A SYSTEMS APPROACH FOR LEGAL AND ADMINISTRATIVE ARRANGEMENTS,
Wisconsin Univ., Madison. Dept. of Regional Planning.
For primary bibliographic entry see Field 06E.
W71-03867

INTERACTION AMONG NATURAL RESOURCE SYSTEMS, THE DECISION MAKERS AND THE PUBLIC IN THE 2000's,
Iowa State Univ., Ames. Dept. of Civil Engineering.
For primary bibliographic entry see Field 06B.
W71-03868

A REVIEW OF THE 1969 LITERATURE ON WASTE WATER AND WATER POLLUTION CONTROL, ADMINISTRATION: SYSTEMS ANALYSIS,
Cornell Univ., Ithaca, N.Y.
For primary bibliographic entry see Field 05G.
W71-03879

SYSTEM OPTIMIZATION FOR RIVER BASIN WATER QUALITY MANAGEMENT,
Weston (Roy F.), Inc., West Chester, Pa.
For primary bibliographic entry see Field 05G.
W71-03881

MATHEMATICAL MODELS AS AN AID IN THE SOLUTION OF WATER POLLUTION CONTROL PROBLEMS,
Water Pollution Research Lab., Stevenage (England).
For primary bibliographic entry see Field 05G.
W71-03884

WATER RESOURCES SYSTEMS ENGINEERING,
California Univ., Riverside. Dept. of Engineering; and California Univ., Los Angeles. Dept. of Engineering.
Warren Hall, and John A. Dracup.
McGraw Hill Book Co, Series in Water Resources and Environmental Engineering, New York, 1970. 372 p, 42 fig, 2 tab, 325 ref.

Descriptors: *Systems analysis, *Optimization, *Water resources, *Engineering, Decision making, Operations research, Groundwater, Water quality control, California.

Certain fundamentals of the systems approach to complex water resources problems were discussed using specific systems and subsystems as examples because of their value as analytical methods developed and adapted to particular water problems. The introductory chapter explained the need for the best possible analysis to back the decision process. The case for systems analysis, if practiced by competent, professional water engineers, was established. A review of the characteristics of water resources systems as they relate to operations-research methodologies was then given. The fundamental procedures for several methodologies used by the systems-engineer were presented. Then, possible objective functions for the analysis of water resources systems were identified and the multiplicity of noncommensurate objectives of complex systems was emphasized. Analyzed were a spectrum of water resources subsystems selected so that the methods and results were compatible in objectives, inputs and outputs. The primary water use subsystems noted were agricultural. The investment-timing problem was emphasized. The northern California supply subsystem was taken as the prototype for an analysis of water resources subsystems in the planning of a complex water supply-distribution-use system. Groundwater resources and water quality subsystems were discussed. Has 325 references. (Kriss-Carol)
W71-03885

DESIGN CAPACITIES TO ACCOMMODATE FORECAST UNDERTAINTIES,
Gesellschaft zur Wiederaufarbeitung von Kernbrennstoffen m.b.H., Mannheim (West Germany); and Wisconsin Univ., Madison. Dept. of Civil Engineering.
Paul M. Berthouex, and Lawrence B. Polkowski.
Journal of the Sanitary Engineering Division, ASCE, Vol 96, No SA5, p 1183-1210, October 1970. 28 p, 12 fig, 5 tab, 2 append, 63 ref.

Descriptors: *Optimization, *Mathematical models, *Systems analysis, *Economies of scale, *Forecasting, Costs, Sewage treatment, Probability, Sanitary engineering.

Economic safety factors have been developed to provide a hedge against errors inherent in using population forecasts. Optimal treatment plant expansions were calculated by minimizing the expected value of long-term investment costs. Factors considered were growth rate, forecast uncertainty interest rate, inflation, and learning-curve effect, and construction cost economy-of-scale. When a linear growth rate was anticipated, the interest rate and the economy of scale factor M determined the design period, the growth rate did not. However, when the growth rate was uncertain, it was possible to hedge against the possible cost of selecting the wrong period of design by reducing the design capacity 5 to 10%. Exponential growth always yielded a shorter design life than the linear growth pattern. Therefore, even when a linear growth in demand was not expected, it was helpful to use the linear growth expansion criterion to establish an upper bound on the design capacity. The examples presented suggested simple optimization methods which were applicable for some situations, and introduced the concept of applying safety factors as a hedge against uncertainty in design forecasts. (Kriss-Cornell)
W71-04026

TOOLS FOR WATER-RESOURCE STUDY,
Illinois State Water Survey, Urbana.
Julius H. Dawes.
Journal of the Irrigation and Drainage Division, ASCE, Vol 96, No IR4, p 403-424, December 1970. 22 p, 18 fig, 3 tab, 10 ref, 2 append.

Descriptors: *Water resources development, *Cost-benefit analysis, Reservoirs, Pumps, Wells, Sewage treatment, Data collection, Management, Economics.

Studies that have been made or are currently under way at the Illinois State Water Survey on the cost and benefit of various elements of water resource development were described. Some of the Illinois studies completed were: Cost of Reservoirs; Costs of Wells and Pumps, Water Transmission Costs; Cost of Pumping Water; and Cost of Sewage Treatment. A full account, including data collection, data analysis, and cost comparisons, were given for each study. Examples for use of the methods developed were also presented. The Illinois State Water Survey intended that these tools be used as a basis for comparison between alternatives for creation of water resource use, development and, management models. The results were said to have the same degree of certainty as incorporated in the basic data. The costs estimates will be helpful in linking quantity, quality, and economic parameters to the physical system, and alternative solutions to meet the objectives determined by economic, social and political criteria will be possible. Planners and decision makers will be in a more favorable position knowing what the alternatives and consequences will be from their actions. (Kriss-Cornell)
W71-04027

OPTIMAL ALLOCATION OF STOCHASTIC WATER SUPPLY,
California Univ., Riverside. Dry-Lands Research Inst.; and New South Wales Univ., Kensington. School of Civil Engineering.
For primary bibliographic entry see Field 03B.
W71-04028

APPLYING GRADIENT PROJECTION AND CONJUGATE GRADIENT TO THE OPTIMUM OPERATION OF RESERVOIRS,
Kansas State Univ., Manhattan. Dept. of Industrial Engineering.
For primary bibliographic entry see Field 04A.
W71-04030

OPTIMIZATION FOR PLANNING AND LOCATION OF PRECIPITATION STATIONS IN THE JEMEZ MOUNTAINS,
New Mexico State Univ., University Park. Engineering Experiment Station.
Jon D. Hicks, and J. V. Lunsford.
Technical Report No 65, August 1970. 176 p, 31 fig, 8 tab, 4 append, 9 ref. NMSU-EES-65-70.

Descriptors: *Optimization, *Correlation analysis, *Computer programs, *Project planning, *Relocation, *Precipitation (Atmospheric), Data collection, Mapping, New Mexico.
Identifiers: Jemez Mountains.

One of the stated objectives of the Weather Modification Research Program being conducted in the Jemez Mountains by New Mexico State University was the development of an adequate terrestrial precipitation measurement system. The objectives of this study were to determine, by correlation analysis, if the precipitation station locations utilized in the first winter of operation were located for the most effective data collection and to develop procedures for analysis by which subsequent data from relocated stations could be similarly analyzed. Computer programs were presented which computed the necessary statistics needed in the evaluations and a graphical mapping procedure was presented which aided in the understanding of the statistics computed. Based on the correlation of the event totals of each station with all other stations, and the areas of iso-correlation as shown on the maps, eleven stations could be relocated for more efficient data collection. It was recommended that a minimum distance of five miles between the stations in all directions be suggested for efficient data collection. A map of a possible relocation pattern based on the results of this study was shown. (Kriss-Cornell)
W71-04033

MATHEMATICAL PROGRAMMING APPLICATIONS TO WATER QUALITY PLANNING FOR THE BOSTON HARBOR REGION,
Massachusetts Inst. of Tech., Cambridge. Urban Systems Lab.
For primary bibliographic entry see Field 05G.
W71-04036

AN APPROACH TO FINDING RESERVOIR RULES FOR POWER OPTIMIZATION,
Water Resources Engineers, Inc, Walnut Creek, Calif.
For primary bibliographic entry see Field 04A.
W71-04037

A WATER-QUALITY SIMULATION MODEL FOR WELL-MIXED ESTUARIES AND COASTAL SEAS: VOLUME I, PRINCIPLES OF COMPUTATION,
Rand Corp., Santa Monica, Calif.

J. J. Leendertse.
Memorandum, RM-6230-RC, February 1970. 71 p, 27 fig, 15 ref.

Descriptors: *Simulation analysis, *Mathematical models, *Water quality control, Estuaries, Coasts, Tidal waters, Flow, Wastes, New York.
Identifiers: Jamaica Bay.

The principles of computation of water quality simulation in well-mixed estuaries and coastal seas were described. The model was based upon numerical integration of the flow equations which simulated the water movements of tides and upon numerical integration of the advective diffusion equation which represented the movement of dissolved waste constituents. The partial differential equations which formulated the two-dimensional movement of waste constituents were approximate by two difference equations, which were used in succession for a step-by-step solution in time. To assess the validity of the results obtained an analysis was made of the behavior of the solution method. The computational procedures were tested on models of Jamaica Bay, Long Island, New York. A model with a computational grid size of 500 feet was used for the computational tide levels and velocities in this shallow bay, which has many tidal flats. In addition, the dispersion of coliform bacteria from a large number of time-varying sources were computed. (Kriss-Cornell)
W71-04038

OPTIMIZATION OF WATER RESOURCE SYSTEMS INCORPORATING EARTHQUAKE RISK: PROGRESS REPORT NO 1,
California Univ., Los Angeles.
C. M. Duke, and J. A. Dracup.
Progress Report No 1, June 1970. 57 p, 11 fig, 78 ref, append. OWRR Project B-017-CAL (1).

Descriptors: *Optimization, *Water resources development, *Earthquakes, *Costs, Statistical methods, Damages, Risks.

Water resource system planning was optimized with respect to earthquake risk by incorporating the earthquake and cost functions into the optimization process. Emphasis was placed on water resource systems rather than individual structures or components. The focus was on planning decisions such as aqueduct routing and reservoir locations. The earthquake effects considered were classed as (1) violent shaking and (2) permanent differential displacements related to fault movement. Some guidance as to costs of making system components earthquake resistive was provided through documented cases of damage and non-damage in past earthquakes. The key cost parameter in this research was the cost to design, build and maintain the structure to withstand effects that have produced failures. The generation, flow and processing of information relative to the earthquake effects on a designated type of structure at a specified site in a water resource system was shown. Cost provided the language as well as the criteria for optimization and the cost increment to enable the system to resist earthquake effects was represented. Distribution of earthquakes was expressed statistically in terms of size, space and time. Specific forces, due to shaking and fault slip, applied to the structure by earthquakes that occur over its design life were determined. The procedure used led to an estimate of the incremental earthquake cost of placing a particular type of structure (e.g. an earth dam) on a specific site (e.g. Bouquet Canyon). (Kriss-Cornell)
W71-04041

OPTIMAL OPERATION OF WATER SUPPLY SYSTEMS,
Arizona Univ., Tucson. Hydrology and Water Resources.
For primary bibliographic entry see Field 04B.
W71-04042

MODELING AND OPTIMIZATION OF WATER RESOURCES SYSTEMS - PHASE I,
Kansas State Univ., Manhattan. Dept. of Industrial Engineering.
F. S. Lee, L. E. Erickson, L. T. Fan, P. D. Dand, and R. S. Shastry.
OWRR Grant No 14-01-0001-1962. Completion Report (1970), various pagings. 50 fig, 31 tab, 105 ref, 13 append.

Descriptors: *Optimization, *Model studies, *Dynamic programming, *Stochastic processes, *Water resources development, Reservoirs, Linear programming.
Identifiers: *Techniques, *Steady state conditions.

Recently developed techniques used in water resources modeling and optimization were presented. Three general classes of problems dealt with were: the modeling and optimization under steady state conditions, the modeling and optimization under dynamic or unsteady state conditions, and stochastic modeling optimization. Results obtained were summarized under the titles: single reservoir system, multiple reservoir system, the establishment and up-dating of water resources model, and development of additional techniques. The detailed discussion of these problems was presented in each of the appendices. Such specific techniques as dynamic programming, a search technique, the stochastic maximum principle, conjugate gradient and gradient projection, quasilinearization, and others were used to formulate the models described in the individual papers. (See also W71-04044 thru W71-04047) (Kriss-Cornell)
W71-04043

A NONLINEAR MULTIPLE RESERVOIR WATER RESOURCES MODEL WITH MULTIPLE PURPOSES,
Kansas State Univ., Manhattan. Dept. of Industrial Engineering.
For primary bibliographic entry see Field 04A.
W71-04044

STREAM QUALITY MODELING BY QUASILINEARIZATION,
Kansas State Univ., Manhattan. Dept. of Industrial Engineering.
For primary bibliographic entry see Field 05F.
W71-04045

OPTIMUM OPERATION OF MULTIPLE RESERVOIRS WITH MULTIPLE PURPOSES,
Kansas State Univ., Manhattan. Dept. of Industrial Engineering.
For primary bibliographic entry see Field 04A.
W71-04046

OPTIMIZATION OF WATER RESOURCES SYSTEMS BY THE GRADIENT PROJECTION METHOD,
Kansas State Univ., Manhattan. Dept. of Industrial Engineering.
E. S. Lee, and P. D. Dand.
In: Modeling and Optimization of Water Resources Systems Phase I, Kansas State Univ, Appendix B2, (1970). 22 p, 2 fig, 5 tab, 10 ref.

Descriptors: *Optimization, *Water resources, Multiple-purpose reservoirs, Computers, Constraints.
Identifiers: *Gradient projection method, Nonlinear programming.

The gradient projection model was applied to the optimization of complex water resources systems. This was a nonlinear programming technique used to treat the nonlinear utility functions without simplification and to solve the large number of variables involved without dimensionality difficulties. Two water resources problems involving multiple reservoirs and multiple purposes were solved by the technique. To illustrate the approach, an example solved by Maass and coworkers was solved by the gradient projection method. The two multi-purpose reservoirs used had the purposes of irrigation and power generation. It was assumed that there are two seasons in a year, the dry season and the wet season. The flow data and flow balances were shown. Constraint equations were formulated and the problem was solved by the gradient projection method. A four-period water resources model was then shown. With very approximate initially guessed values on the variables, only three to five iterations with a few seconds computation were needed to obtain the optimum. (See also W71-04043) (Kriss-Cornell)
W71-04047

NATURE'S LAW AND MAN'S ETHIC,
Army Engineer District, Omaha, Nebr. Design Branch.
For primary bibliographic entry see Field 04C.
W71-04069

THE MANAGEMENT OF FORESTED WATERSHEDS FOR DOMESTIC WATER SUPPLIES,
Forest Service (USDA), Upper Darby, Pa. Northeastern Forest Experiment Station.
Edward S. Corbett.
Proc Conf Multiple-Use of Southern Forests, Ga Forest Res Council and Ga Forestry Assoc, p 35-38, 1970.

Descriptors: *Domestic water, *Watershed management, *Water yield improvement, Water quality, Recreation, Forestry, Northeast U.S.

The Northeastern Forested Municipal Watershed Survey elicited 626 completed questionnaires from municipalities, private water companies, and State and Federal agencies. Over 2 million acres of land in the Northeast are under control of over 750 management units as water-source areas or protection lands for municipal water supplies. Increasing water yield, protecting water quality, meeting recreation demand, and other problems are discussed. (Reinhart-Forest Service)
W71-04244

6B. Evaluation Process

NATURAL RESOURCE SYSTEMS MODELS IN DECISION MAKING.
Purdue Univ., Lafayette, Ind. Water Resources Research Center.
For primary bibliographic entry see Field 06A.
W71-03855

WATER RESOURCES PLANNING IN THE URBAN-METROPOLITAN CONTEXT,
North Carolina Univ., Chapel Hill. Dept. of City and Regional Planning.
Maynard M. Hufschmidt.
In: Natural Resource Systems Models in Decision Making, Lafayette, Indiana, Water Resources Research Center, Purdue University, p 115-135, 1970. 5 fig, 8 ref.

Descriptors: *Planning, *Cities, *Methodology, *Water resources, River basins, Economic efficiency, Federal government.
Identifiers: *Metropolitan water resource management, Urban water systems planning, Water resource planning, Income redistribution, Environmental quality, Objectives, River basin planning.

The major emphasis in water resources planning by federal agencies is on macro-systems in a river basin context. This planning practice is increasingly less relevant to metropolitan water resource development. This gives rise to two types of questions. First, what is being done in the way of urban water systems planning and which are the systems characteristics. Second, what changes in the water planning methodology are needed in the

urban context. The often advanced objectives of economic efficiency, income redistribution, and environmental quality remain basic, but the relative attention to specific problems will change. A basic problem is the divergence between urban and federal objectives where federal funding of needed works is involved. Such divergence becomes more apparent when considering refinement of basic objectives in the form of guides and criteria. The federal attention to the river basin can be at odds with conditions following from urban geography. Also the ranking of problems as to significance reveals basic differences. These topics are discussed with the aid of examples drawn from urban settings in the eastern USA. (See also W71-93855) (Davis-Chicago)
W71-03861

INCORPORATING SOCIAL OBJECTIVES IN SYSTEMS MODELS,
Kentucky Univ., Lexington. Dept. of Civil Engineering.
L. Douglas James.
In: Natural Resource Systems Models in Decision Making, Lafayette, Indiana Water Resources Research Center, Purdue University, p 136-151, 1970. 3 tab, 10 ref.

Descriptors: *Planning, *Analytic techniques, *Evaluation, Model studies, Economic efficiency, Systems analysis, Flood protection.
Identifiers: *Social objectives, Environmental quality, Regional development, Income redistribution, Financial stability.

Water resources planners are now beginning to recognize the need to supplement the evaluation of proposed projects from the viewpoint of economic efficiency with consideration of such social objectives as environmental quality, regional development, income redistribution, and financial stability. Projects can be used to accomplish or serve to defeat these objectives in many different ways. Project formulation for a specific flood hazard area, for example, seeks the most appropriate combination of structural, flood-proofing, and land-use-restriction measures. The evaluation requires determination of the effects of each combination of measures on each social objective. An alternate approach is to estimate implied weighting factors from past resource development decisions and proceed through a comparison of alternatives seeking to maximize the resulting scalar index of value. This approach can be used in systems modeling to avoid periodic stops for inputting outside value judgements. Sensitivity studies can be used to evaluate the implications of giving a variety of weightings to relevant objectives. The model builder can only legitimately determine how expressed needs are best supplied; the people must express the objectives. (See also W71-03855) (Davis-Chicago)
W71-03862

PRIVATE AND SOCIAL COSTING AS DECISION DETERMINANTS IN WATER RESOURCES,
Rutgers-The State Univ., New Brunswick, N.J. Water Resources Research Inst.
Wm. Whipple, Jr.
In: Natural Resource Systems Models in Decision Making, Water Resources Research Center, Purdue University, Lafayette, Ind., p 162-178, 1970.

Descriptors: *Economics, *Interest, *Risk, *Costs, *Decision making, Benefits, Cost-benefit-analysis, Economic justification, Resource allocation, Third party effects, Social aspects.
Identifiers: *Social costs, *Externalities, Opportunity costs.

The paper's theses are (a) just as private costs are used in business decisions, social costs should be determinants in public decision-making; (b) many principles of social cost determination are available for use; (c) such principles are absent when it comes to interest rate and taxation questions; (d) work on the social cost of pollution is urgently needed. Differences in rates of return after taxes can be ordered in terms of disutility of unexpected losses. It is proposed that the social cost of Federal investment be computed using a discount rate equal to that of Federal bonds, less an allowance for currency depreciation, plus an allowance for risks assumed. It is reasoned that the relationship between taxation and social costs is in need of much more investigation before the established system can be declared unsound. (See also W71-03855) (Whipple-Rugers)
W71-03864

INTERACTION AMONG NATURAL RESOURCE SYSTEMS, THE DECISION MAKERS AND THE PUBLIC IN THE 2000's,
Iowa State Univ., Ames. Dept. of Civil Engineering.
Merwin D. Dougal.
In: Natural Resource Systems Models in Decision Making, Lafayette, Indiana, Water Resources Research Center, Purdue, University, p 222-245, 1970. 8 fig, 2 tab, 23 ref, 3 append.

Descriptors: *Decision making, *Natural resources, *Institutional constraints, Technology, Attitudes, Social aspects, Political aspects, Environment.
Identifiers: *Environmental management, *Resource management.

The areas of relevance in regard to the interaction considered herein are: (1) attitudes, (2) knowledge, (3) technology, (4) choices and decision making, and (5) public institutions for environmental management. Attitudes need to be redirected from that of entrepeneurial service to public service. The major area of inadequacy with respect to knowledge lies in the response of natural environment to man's activities. Technology is limited in its problem-solving capability by the inadequacy of knowledge of environmental response. Making choices and decisions involves many intangibles. Therefore, attitudes become increasingly important to the decision-making process. Regional insitutions for resource and environmental management must be developed if real progress in problem-solving is to be accomplished. These concepts are illustrated by results of several local studies set in Iowa. (See also W71-03855) (Davis-Chicago)
W71-03868

AN ECONOMIC EVALUATION OF THE WATER QUALITY ASPECTS OF CONTRA COSTA COUNTY'S OFFSHORE WATER SUPPLY.
Metcalf and Eddy, Inc., Palo Alto, Calif.

Report to the Contra Costa County Water Agency, Martinez, California, November 16, 1965. 287 p, 37 fig, 56 tab, 61 ref.

Descriptors: *Economic prediction, *Evaluation, *Water quality control, *Deltas, *Water pollution control, *Encroachment, *Saline water-freshwater interfaces, Salinity, Sea water, Saline water intrusion, Estuaries, Brackish water, Tidal effects, Annual benefits, California.
Identifiers: *Contra Costa County, San Francisco Bay, Sacramento-San Joaquin Delta.

An attempt was made to reduce to the cost frame of reference the benefits or detriments to those segments of the County's economy which may be affected by changes in the quality of the offshore waters, now and in the future. The uncertainty of future Delta water supplies has required that the recent past historical water quality be used as a basis for benefit determinations. The benefits included are those which are susceptible of monetary evaluation. This area studied is the central and eastern portion of the County and represents about 30 percent of the total county. The two main sources of impaired water quality are: (1) salt water incursion from San Francisco Bay; (2) mineralization of the fresh offshore waters by return flows of irrigation from the Central Valley via the San Joaquin River system. Offshore water quality criteria are assumed for two distinct methods of achieving quality control: (1) construction of a physical barrier at Dillon Point or Chipps Island, and (2) a hydraulic barrier consisting of regulated fresh water outflows for salinity repulsion. Estimates are given of the annual savings to presently established and future industry and the economic benefits related to groundwater, recreation, fisheries, agriculture, municipal water supplies, unimproved land values, and the assimilative capacities of offshore waters. Benefits are estimated for the present and the year 2000. (Poertner)
W71-03909

THE ECONOMIC IMPACT OF ALTERNATIVE WATER CONDITIONS, A REPORT TO THE CONTRA COSTA COUNTY WATER AGENCY.
Metcalf and Eddy, Inc., Palo Alto, Calif.

Report to the Contra Costa County Water Agency, Martinez, California, April 8, 1969. 103 p, 14 fig, 4 tab, 8 ref.

Descriptors: *Economic prediction, *Evaluation, *Water quality control, *Water pollution control, *Encroachment, *Saline water-freshwater interfaces, Deltas, Salinity, Sea water, Saline water intrusion, Estuaries, Tidal effects, California.
Identifiers: *Contra Costa County, *Sacramento-San Joaquin Delta.

Specific water quality control proposals were evaluated and the effects studied of a diminishing fresh water supply on Western Sacramento-San Joaquin Delta water quality and on the economy and environment of the area. Where possible, monetary values have been assigned. Chloride-ion concentration was selected as the primary control constituent because it is an indicator of the degree of salt water incursion in the estuarine system of the Western Delta. Other water quality constituents, such as total dissolved solids and total hardness, were also considered because of their effects on the market uses of water. Three factors influence the future availability of Contra Costa's offshore water supply: (1) increasing upstream depletions and out-of-basin export; (2) increasing quantities of agricultural, municipal and industrial wastes which are discharged to tributary receiving waters upstream from the Western Delta; (3) changes in the tidal hydraulics of San Francisco Bay and the Delta from land filling and reclamation projects. Conclusions concerning ecological changes and the economic impact of alternative water conditions are presented, based on the year 2000 and the present. The monetary benefits or detriments to Contra Costa's water-using industry, municipalities and agriculture have been computed for three distinct offshore water quality conditions. The economic effects of water quality changes on wastes dischargers have also been determined.
W71-03910

A MULTI-PHASIC COMPONENT STUDY TO PREDICT STORM WATER POLLUTION FROM URBAN AREAS,
Avco Economic Systems Corp., Washington, D.C.
For primary bibliographic entry see Field 05C.
W71-03917

TOOLS FOR WATER-RESOURCE STUDY,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 06A.
W71-04027

COMMENTS ON 'THE LINEAR DECISION RULE IN RESERVOIR MANAGEMENT AND DECISION RULE IN RESERVOIR MANAGEMENT AND DESIGN' BY CHARLES REVELLE, ERHARD JOERES AND WILLIAM KIRBY,
Harvard Univ., Cambridge, Mass.
L. M. Eisel.

Water Resources Research, Vol 6, No 4, p 1239-1241, Aug 1970. 4 p, 1 fig, 7 ref.

Descriptors: *Evaluation, *Linear programming, *Reservoir design, Management, Constraints.

The author discussed ReVelle's et al proposed reservoir operating policy which simplified reduction of probabilistic chance constraints to their deterministic equivalents. A comparison to Young's, Bryant's, and Watermeyer and Thomas' investigations of optimal and near optimal linear operating rules was made. In both the deterministic and stochastic models, the assumptions were unclear regarding initial storage, which was expressed as a function of reservoir capacity. The form of the constraints incorporated into the stochastic case was also unclear. ReVelle, et al gave insufficient demonstration that their chance-constrained model adequately represented reality for preliminary screening or more advanced design purposes. (Kriss-Cornell)
W71-04029

PROCEEDINGS OF A SEMINAR ON RESERVOIR SYSTEMS ANALYSIS, 4-6 NOVEMBER 1969.
Corps of Engineers, Davis, Calif. Hydrologic Engineering Center.
For primary bibliographic entry see Field 04A.
W71-04034

REPLY,
Geological Survey, Washington, D.C.
W. Kirby, C. ReVelle, and E. Joeres.
Water Resources Research, Vol 6, No 4, p 1242-1245, Aug 1970. 4 p, 4 ref.

Descriptors: *Optimization, Evaluation, Reservoir Operation, Design, Management, Economics.
Identifiers: *Linear decision rule (LDR).

A reply to comments made by Loucks and Eisel on the authors' paper 'The Linear Decision Rule in Reservoir Management and Design' was made (See also W70-10054). These comments illuminated several problems in the interpretation and economic justification of linear decision rules. Four specific points were made: (1) that the observation that Young's linear operating rules were of a different form from the linear decision rule (LDR) was embarrassingly correct; (2) that Loucks' interpretation of the initial storage constraints was correct and applied equally well to the deterministic formulation; (3) that Loucks suggests that the LDR does not deal effectively with serially dependent input processes; and (4) that Eisel points out that the LDR model should be compared with more realistic models to validate the LDR assumptions and to assess the quality of the LDR design. Despite these and other objections, the authors try to prove that the LDR bears consideration as a useful complement to existing optimization models and as a conceptual basis for further development of reservoir management theory. (Kriss-Cornell)
W71-04035

SUPERPOSITION OF SUBMONTHLY FLOWS IN STOCHASTIC HYDROLOGY,
North Carolina Univ., Chapel Hill.
For primary bibliographic entry see Field 02E.
W71-04040

WATERSHED PROJECTS.
For primary bibliographic entry see Field 06E.
W71-04104

IRRIGATION DEVELOPMENT IN TUNISIA,
California State Coll., Long Beach. Dept. of Geography.
For primary bibliographic entry see Field 03F.
W71-04232

SPATIAL PATTERNS OF SOCIO-ECONOMIC STRUCTURE IN INDIA,
Iowa Univ., Iowa City. Inst. of Urban and Rural Research; Iowa Univ., Iowa City. Dept. of Geography; and Northern Illinois Univ., De Kalb. Dept. of Geography.
Frank E. Horton, Harold McConnell, and Ranjit Tirtha.
Tijdshrift voor Economische und Sociale Geografie, Vol 61, No 2, p 101-113, March-April 1970. 7 fig, 10 tab, 9 ref.

Descriptors: *Regional analysis, *Estimating equations, *Statistical methods, *Water utilization, *Geographical regions, Correlation analysis, Regression analysis, Frequency analysis, Arid lands, Humid climates, Data collections, Mapping, Social aspects, Economic efficiency, Foreign countries, Tropical regions, Topography, Climates, Regions, Environmental effects, Water users, Natural resources, Water resources, Analytical techniques, Moisture availability, Urbanization, Rural areas, Agriculture, Spatial distribution, Variability.
Identifiers: *Socio-economic patterns, *India, *Developing countries, Multivariate principle components analysis.

An attempt is made, using Indian government data, to identify underlying patterns of areal association using 15 selected socio-economic indices (variables) which are considered to reflect the significance of India's socio-economic structure, statistical techniques were designed to elicit a maximum amount of information from a minimum number of relevant variables. Product-moment correlation coefficients were used as inputs to a multivariate principle components analysis and the basic association patterns of India's socio-economic structure emerged: socio-economic development, socio-economic underdevelopment, incipient commercialization, rural manufacturing and agricultural intensity. The physical, social and economic factors underlying these patterns are described, the spatial variations mapped and the data analyzed for internal homo-or heterogeneity. The highest positive values showed systematic clustering, conforming to major political and physical subdivisions. The major categories of socio-economic structure are associated mainly with social and water availability factors. The categories are: (A) developed urban-involving literate populations and large-scale industry; (B) backward tribal areas with inhospitable terrains such as forest cover or arid lands, augmenting inaccessibility; (C) flat, fertile lands and an adequate water supply with or without irrigation, supporting an urban-rural hierarchy; (D) areas of comparatively low water availability where agricultural income is supplemented with household activities and (E) areas with the greatest water availability, whether irrigation or rainfall, and with sufficient market incentives. (Casey-Arizona)
W71-04234

ECONOMIC ANALYSIS OF MARINAS IN MARYLAND,
Maryland Dept. of Chesapeake Bay Affairs, Annapolis; and Maryland Univ., College Park. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 06D.
W71-04267

ASPECTS OF PLANNING, EVALUATION, AND DECISION-MAKING IN SPORT FISHERY MANAGEMENT.
New York State Coll. of Agriculture, Ithaca. Dept. of Conservation.

Fourth New York Fishery Biologists' Seminar, Department of Conservation Extension Series, No 1, March 28, 1968. 23 p.

Descriptors: *Planning, *Cost-benefit analysis, Natural resources, New York, *Sport fishing, Fish management.
Identifiers: *New York State's PPB system, Adirondacks, Ciriacy-Wantrup.

These five short papers, four of which were written by Cornell University Natural Resource Professors and one by the Director of Program Planning for the New York State Conservation Department, all describe the need for a diversified approach to solving natural resource problems. Diversity in methods of planning and programming, economic analysis, benefit-cost methodology, as well as diversification of natural environments are advocated. Since planning the conservation of natural resources requires consideration of benefits and costs which do not lend themselves to dollar values, the authors have suggested various methods for taking these non economic factors into account. These five papers were presented at the Fourth New York Fishery Biologists' Seminar on March 28, 1968. Appropriate portions of the publication are forwarded with abstracts of these portions. (See also W71-04272 thru W71-04274) (Holmes-Rutgers)
W71-04271

THE ROLE OF ECONOMIC EVALUATION IN GOVERNMENTAL ANALYSIS,
New York State Coll. of Agriculture, Ithaca. Dept. of Conservation.
Robert J. Kalter.
In: Aspects of Planning, Evaluation and Decision-Making in Sport Fishery Management, Department of Conservation Extension Series No 1, Cornell University, May 28, 1968, p 12-13.

Descriptors: *Cost-benefit analysis, Input-output analysis, *Evaluation, Economics, Government finance.
Identifiers: Corps of Engineers.

The author describes the advantages and disadvantages of the analytical tool cost-benefit analysis for evaluating government programs. He explains that this type of analysis is not adaptable for evaluating projects which have several varied objectives and goals. He suggests that tools like input-output analysis to quantify regional development effects and the various methods used to evaluate income distribution effects should all be applied more often. (See also W71-04271) (Holmes-Rutgers)
W71-04272

EVALUATION OF INTANGIBLES,
New York State Coll. of Agriculture, Ithaca. Dept. of Conservation.
Ronald L. Shelton.
In: Aspects of Planning, Evaluation and Decision-Making in Sport Fishery Management, Department of Conservation Extension Series No 1, Cornell University, May 28, 1968, p 14-17. 1 ref.

Descriptors: Water resource development, Environmental effects, Cost-benefit analysis, *Evaluation, *Intangible benefits, Intangible costs, Planning.
Identifiers: *Guide to Benefit-Cost Analysis.

A recommendation is made that environmental objectives be considered along-side economic objectives when resource planning. Three major criteria for evaluating the environmental objectives are stated: uniqueness, diversity, and general health or proper functioning within the environment. Although environmental benefits are often considered to be intangible, the author considers these environmental objectives 'almost as tangible as maintaining economic stability.' (See also W71-04271) (Holmes-Rutgers)
W71-04273

AN ECOLOGICAL CRITERION FOR EVALUATING AN ENVIRONMENT,
New York State Coll. of Agriculture, Ithaca. Dept. of Conservation.
Bruce T. Wilkins.
In: Aspects of Planning, Evaluation and Decision-Making in Sport Fishery Management Department of Conservation Extension Series No 1, Cornell University, May 28, 1968, p 18-23. 2 ref.

Descriptors: *Decision-making, *Environmental effects, Resource allocation, New York, Lake Erie, *Natural resources, Evaluation.
Identifiers: Adirondacks, Forest preserve, Preservation of agricultural land.

Diversity is one of the major criteria in the development of natural resources. A monoculture is less stable than a complex of organisms--catastrophic results associated with such things as disease, predators, weather influences, or absence of buffer species are more likely to occur as diversity shrinks. It is concluded that society minimized risk by maintaining diversity which may have the effect of sacrificing maximum productivity. (See also W71-04271) (Holmes-Rutgers)
W71-04274

POLLUTION PROBLEMS, RESOURCE POLICY AND THE SCIENTIST,
New York State Coll. of Agriculture, Ithaca. Dept. of Conservation.
Alfred W. Eipper.
The Cornell Plantations, (Research Issue), winter 1969-70, Vol 25, No 4, p 51-60. 14 ref.

Descriptors: *Water resources development, *Decision-making, Water pollution control, New York, *Water pollution control.
Identifiers: Cayuga Lake.

Basic principles of resource management decision-making which apply particularly to water pollution control problems are outlined. Decisions are public decisions and cannot be made unilaterally by any particular interest group. Conventional economic criteria cannot be used as the sole basis for natural resource decisions. Resource managers have an obligation to future generations to maintain the quality of natural environment remaining. (Holmes-Rutgers)
W71-04280

A GUIDE TO USING INTEREST FACTORS IN ECONOMIC ANALYSIS OF WATER PROJECTS,
Bureau of Reclamation, Denver, Colo., Engineering and Research Center.
B. P. Glenn, and Edmund Barbour.
For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Price $1.50. Water Resources Technical Publication, December, 1970. 99 p, 14 tab, 16 fig, 5 append.

Descriptors: *Government finances, *Interest, *Discount rate, *Cost-benefit analysis, Economic life, Risk.

The concept of interest as a return for the use of money requires that values occurring at different points in time be adjusted to a common basis before they are compared. The text discusses and demonstrates procedures of deriving economic equivalents through the use of interest and annuity factors and develops interest factors including factors for uniform increasing and decreasing series of values. Topics covered include interest during construction, periods of analysis, stage construction, development period factors, the rate of return method of analysis, capital fixed charge factors, and payout schedules. Examples are included for derivation of a commercial power rate and a municipal and industrial (M and I) water supply rate. A computer solution to a payout problem is also provided. This is an excellent manual for implementation of Federal policy; but basic economic questions involved in determining interest and discount rates are not discussed. (Whipple-Rutgers)
W71-04283

ECONOMIC CONSIDERATIONS IN FACILITY PLANNING,
American Water Works Service Co., Inc., Philadelphia, Pa.
Thomas C. Earl, and Stanley A. Greenstein.
Journal American Water Works Association, Vol 62, No 11, November 1970, p 705-707. 2 fig.

Descriptors: *Public utilities, *Long-term planning, *Decision making, *Economics, Estimating, Methodology, Feasibility studies, Project feasibility, Project planning, Future planning (Projected), Forecasting, Analytical techniques, Cost analysis, Economic feasibility, Evaluation, Financing, Utilities, Planning, Water resources development.

The current period of high interest rates and escalating construction costs requires careful consideration of economic factors during the planning of facility expansion. Population, commercial and industrial growth trends must be studied to determine long-range customer requirements. A comprehensive planning study should result in the most economical method of meeting future customer demands. When two alternative methods of reaching a desired result exist, a present worth analysis may be used to find the most economical one. Utilities usually borrow money to finance capital projects. The cost of this money is the interest which must be paid to the lender. The means of raising funds are different for public and private utilities. These differences affect the interest rates which must be paid, hence, the present worth analyses are affected also. Present worth analyses require the determination of capital requirements for future construction. The method recommended by the authors involves the estimation of construction costs using current data, the preparation of graphs which show annual increases in costs for major items, and the correction of the initial estimate on the basis of information gained from the graphs. Major construction projects may be postponed in the hope that interest rates will drop, but these gains may be more than offset by rising construction costs. (Hewett-Rutgers)
W71-04285

THE IMPACT OF AGRICULTURAL CHANGE ON A LOCAL ECONOMY IN THE GREAT PLAINS,
Colorado State Univ., Fort Collins.
For primary bibliographic entry see Field 03F.
W71-04289

DRY LANDS AND A HUNGRY WORLD,
Oak Ridge National Lab., Tenn.
Gale Young.
New York Academy of Sciences, Transactions, Ser. II, Vol 31, No 2, p 145-187, February 1969. 22 fig, 12 tab, 55 ref.

Descriptors: *Arid lands, *Desalination, *Water costs, *Nuclear power plants, *Cost-benefit analysis, Economic feasibility, Human population, California, Deserts, Irrigation systems, Planning, Nitrogen, Fertilizers, Environmental effects, Numerical analysis, River flow, Valleys, Hydrologic cycle, Cereal crops, Desalination processes, Desalination plants, Crop production, Productivity, Water demand, Distribution, Agriculture, Electric power, Efficiencies, Costs, Industrial plants, Power plants.
Identifiers: *Power costs, *India, *Ganges River Valley, *Developing countries.

The world water budget is reviewed and several major river systems are discussed in detail. Although the world has an enormous amount of water, it is not evenly distributed. The desert land area of the world is far greater than the area of all croplands. The Ganges Plain of India and the San Joaquin Valley in a desert area of California are described and compared in terms of climate, geophysical aspects and current agricultural productivity. The output of the Ganges Plain, relative to its resources, compares unfavorably. An analysis of the problems involved indicates that the factor limiting the conversion from indigenous agriculture to intensive, multi-crop cereal production is not water, soil or sunlight, but power production, which in turn facilitates both N fertilizer production and water transport. Most modern agriculture is essentially petroleum based, but in an underdeveloped, oil-poor country such as India, power production should be based on coal and/or nuclear energy. A detailed budget is worked out for nuclear-powered irrigation water pumping in which crop production is increased sevenfold. The basic production technology and cost structure of nuclear powered desalination are reviewed. Water use efficiency in variou crops and world crop prices are listed. It is argued that in order to achieve an economically feasible agriculture based on nuclear desalination, the number of crops/yr, crop water efficiency, power technology and power costs must all be weighed and coordinated in a careful planning project. (Casey-Arizona)
W71-04291

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

PRIVATE AND SOCIAL COSTING AND PRICING AS DECISION DETERMINANTS,
Ohio State Univ., Columbus. Dept. of Economics.
Richard A. Tybout.
In: Natural Resource Systems Models in Decision Making, Lafayette, Indiana Water Resources Research Center, Purdue, University, p 152-161, 1970. 1 fig, 3 ref.

Descriptors: *Costs, *Economic efficiency, *Decision making, Governments, Compensation, Cost-benefit analysis, Pollution abatement, Water pollution, Standards.
Identifiers: *Social costs, *Private costs, Externalities, Bribery, Inter-industry compensation, Enforced waste ownership, Effluent taxes, Quality standards, Tax credits.

The calculations made in cost-benefit analysis and the private profit calculations are of the same form. In the latter, costs external to the enterprise are not included as the market mechanism does not force the enterprise to do this. One objection to the resulting divergence between social and private costing is the attendant inefficiency. In regard to water pollution, two approaches to internalize social costs have been advanced. These are: legal accountability with inter-industry compensation and bribery. The latter is argued to be impractical. Alternatives available to the Government to decrease the discrepancy between private and social costing are: enforced waste ownership, effluent taxes, quality standards, and tax credits. It may be said that private and social costing lead to rather different decisions in regard to pollution production and abatement. Bringing these calculations in better accord is a complex physical, economic and political problem. It can, however, yield substantial efficiency benefits. (See also W71-03855) (Davis-Chicago)
W71-03863

SURVEY OF COSTS ON METHODS FOR CONTROL OF ACID MINE DRAINAGE POLLUTION,
Bureau of Mines, Pittsburgh, Pa. Area 1 Mineral Resource Office.
For primary bibliographic entry see Field 05B.
W71-03877

EVALUATION OF THE VERTICAL TUBE EVAPORATOR AND THE MULTISTAGE FLASH DESALINATION PROCESSES.
Fluor Corp. Ltd., Los Angeles, Calif.
For primary bibliographic entry see Field 03A.
W71-03913

BOLSA ISLAND NUCLEAR POWER AND DESALTING PROJECT FACILITIES (COST AND DESCRIPTION) AND COST OF DESALTED WATER,
Southern California Metropolitan Water District, San Diego.
For primary bibliographic entry see Field 03A.

W71-03915

BENEFIT-COST ANALYSIS AND MULTIPLE OBJECTIVES: CURRENT ISSUES IN WATER RESOURCES PLANNING,
Bowdoin Coll., Brunswick, Maine; and Wisconsin Univ., Madison.
A. Myrick Freeman, III, and Robert H. Haveman.
Water Resources Research, Vol 6, No 6, p 1533-1539, December 1970. 7 p, 17 ref.

Descriptors: *Benefit-cost analysis, *Water resources development, Public benefits.
Identifiers: Multiple objective planning.

Some basic principles pertinent to a multiple objective planning effort were discussed and both the rationale for the regional development objective and the logical and empirical basis for including some form of regional development in project analysis was considered. Exception was taken to Major's (1969) assertion that we are on the verge of being able to use empirical social welfare functions in public policy analysis. A multiple objective planning problem was said to be an evaluation technique which accomodates both money valued and nonmoney valued effects. Three essentially noncommensurable objectives (national income, regional development, and environmental quality) dealt with by Major were discussed. The use of a regional objective in water resource development was questioned since little is known about the role of water resources investment in regional income charge. This judgement was based on five considerations, which were described in detail. The major criticism to Major's belief that multiple objective public investment planning will lead to discovery of a social welfare function was that it contained a fairly elaborate algebraic and geometric approach to multiple objective benefit-cost criteria without giving sufficient attention to the logical analysis of objectives or the formal aspects of the multiple objective evaluation problem. (Kriss-Cornell)
W71-04023

OPTIMIZATION OF WATER RESOURCE SYSTEMS INCORPORATING EARTHQUAKE RISK: PROGRESS REPORT NO 1,
California Univ., Los Angeles.
For primary bibliographic entry see Field 06A.
W71-04041

ECONOMICS OF THERMAL POLLUTION CONTROL,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05D.
W71-04084

ECONOMIC FEASIBILITY OF SELECTIVE ADJUSTMENT IN USE OF SALVAGEABLE WATERS IN THE TUCSON REGION, ARIZONA,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
For primary bibliographic entry see Field 05D.
W71-04269

CONSTRUCTION COST OUTLOOK - 1970-1971,
James Webber.
Journal American Water Works Association, Vol 62, No 11, November 1970, p 715.

Descriptors: *Construction costs, *Cost trends, Costs, Estimated costs, Inflation (Economic), Economics, Labor supply, Cost comparisons.

Rises in construction costs have far exceeded the expectations of consulting engineers and owners, to the extent that, often, even the lowest bids for jobs exceed the owner's ability to pay. Eighteen to twenty percent increases in construction labor costs have triggered large increases in wages paid to manufacturing employees, and consequently, further price rises are expected. Restrictions on union membership have maintained labor shortages which will severely affect the construction industry in the next few years. Labor productivity is not increasing, and some industrialization of construction will be necessary to offset continuing cost rises. Projects should be designed to be more than just efficient. Bidding should be scheduled to avoid peak bidding periods. Jobs should be widely advertised to insure competition among bidders. Materials should be carefully selected to reduce initial and long-term costs. Capital costs are not likely to drop soon, and waiting until they do will only see compensating rises in construction costs. It is probable that cost inflation will reduce the purchasing power of the construction dollar as much in the first three years of this decade as in the entire decade of the Sixties. (Hewett-Rutgers)
W71-04275

CAN COSTS BE CUT,
Walter B. Sinnot, Joseph D. D'Annunzio, Charles V. Roberts, and Chester A. Ring.
Journal American Water Works Association, Vol 62, No 11, November 1970, p 694-704. 5 tab.

Descriptors: *Construction costs, *Bids, *Induced costs, Contract administration, Planning, Engineers estimates, Economics, Costs, Evaluation, Administration, Cost repayment, Engineering, Design, Construction, Right-of-way.
Identifiers: *Cost reduction.

This paper is a joint discussion by an engineer, a contractor, an equipment supplier and an owner on ways to cut costs during the design and construction of water systems and treatment facilities. The engineer can save money by developing the water supply as a multipurpose impoundment rather than a single purpose impoundment wherever possible, by using the most up-to-date design criteria and technology, and by using functional rather than esthetic materials whenever possible. The bids received for a job may be reduced by lowering the costs a contractor incurs in making a bid, by supplying detailed plans and specifications, and good subsurface data. Things such as rights-of-way, backfilling, concrete finishing, equipment specifications and method of payment can also affect the overall bid by a contractor. Equipment must be chosen to reduce installation, operation, and maintenance costs. Many problems can be avoided and time and money saved by putting out a separate equipment contract. Owners and operators can keep their costs to a minimum by using up-to-date administrative procedures, by using new low-cost materials in construction and maintenance, and by modernizing treatment processes as much as possible. Many utilities waste money by improper planning, and by not planning far enough in advance. (Hewett-Rutgers)
W71-04284

INDUSTRIAL WASTE DESALTING FOR BYPRODUCT RECOVERY,
Office of Saline Water, Washington, D.C.
For primary bibliographic entry see Field 05D.
W71-04286

RECLAMATION IN THE UNITED STATES,
California State. Dept. of Water Resources, Sacramento.
Alfred R. Golze.
Reclamation in the United States, Caldwell, Idaho, Caxton Printers, Ltd., 1961. 486 p, 30 fig, 43 photo, 120 tab, 139 ref.

Descriptors: *Land reclamation, *Federal Reclamation Law, *Reclamation states, *Irrigation, Hydroelectric power, Water allocation (Policy), Federal government, State governments, Federal-state water rights conflicts, Legislation, Administrative agencies, Arid lands, Area redevelopment, Irrigation programs, Economic justification, Legal aspects, Riparian rights, Prior appropriation, River basin development, Cost allocation, Cost repayment, Financing, Federal project policy, Multiple-purpose projects, Operation and maintenance.

Emphasizing both historical background and current data, this study examines reclamation in the United States--as dictated by law and administered by federal, state, and private agencies. The scope of this study is limited to the process of reclaiming western desert land through irrigated agriculture, supported by coordinated development of hydroelectric power. The following areas are examined: (1) the history of reclamation, (2) the economics of reclamation, (3) reclamation law, (4) participating agencies, (5) investigation and authorization of proposed projects, (6) single-purpose projects, (7) multiple-purpose projects, (8) river basin development, (9) allocations of cost, (10) repayment by water users, (11) repayment by power and other users, (12) financing reclamation programs, (13) cost estimating, (14) programming and accounting, (15) settlement, (16) operations and maintenance, and (17) reclamation in the period from 1951 to 1960. Within the area of reclamation law, pertinent constitutional and legislative provisions controlling state and federal reclamation activity are discussed. The doctrines of prior appropriation and riparian law are contrasted in an examination of the control, distribution, and use of water in the 17 western states. The Federal Reclamation Act of 1902 and other federal legislation is considered in terms of federal authority and its relationship to state authority. (Earl-Florida)
W71-04306

6D. Water Demand

GEOGRAPHICAL ASPECTS OF THE USE OF WATER RESOURCES IN THE SOVIET ECONOMY,
Akademiya Nauk SSSR, Moscow. Institut Geografii.
For primary bibliographic entry see Field 03F.
W71-04052

INSURING MAXIMUM BENEFICIAL USE OF WATER THROUGH LEGISLATION,
Kansas Univ., Lawrence.
For primary bibliographic entry see Field 06E.
W71-04099

ECONOMIC ANALYSIS OF MARINAS IN MARYLAND,
Maryland Dept. of Chesapeake Bay Affairs, Annapolis; and Maryland Univ., College Park. Dept. of Agricultural Economics.
Gale H. Lyon, William B. Matthews, Jr., and Dean F. Tuthill.
Maryland Agricultural Experiment Station, Contribution No 4100, Report MP 679, April 1969. 68 p, 5 fig, 33 tab, 14 ref.

Descriptors: *Marinas, *Cost analysis, Income analysis, Economic efficiency, Economies of scale, *Maryland, *Recreation facilities.
Identifiers: *Chesapeake Bay, Anne Arundel County (Md), Baltimore County (Md), Cecil County (Md).

An analysis was made of the costs, revenues and net returns for a sample of limited service type marinas in Maryland. The sample was representative of the five sizes of marinas in the state. In addition, an economies of size analysis was made for five sized model marinas. The medium sized marina, the one accommodating 150 boats, was determined to be the most economic, for the larger marinas encountered higher per unit costs of labor. (Holmes-Rutgers)
W71-04267

A STUDY OF WATER USE IN SINGLE-DWELLING RESIDENCES IN THE CITY OF

CALGARY, ALBERTA, ALBERTA UNIV., EDMONTON (CANADA),
Alberto Univ., Edmonton. Dept. of Agricultural Economics and Rural Sociology.
For primary bibliographic entry see Field 03D.
W71-04287

ALTERNATIVE CROP ENTERPRISE BUDGETS FOR IRRIGATED PRODUCTION, SOUTHWESTERN OKLAHOMA,
Oklahoma State Univ., Stillwater. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 03F.
W71-04294

WATER USE IN TENNESSEE, PART D - SUMMARY,
Tennessee Dept. of Conservation, Nashville. Water Resources; and Geological Survey, Nashville, Tenn.
John M. Wilson, and Alfred M. F. Johnson.
1970. 19 p, 8 fig, 9 tab, 24 ref.

Descriptors: *Tennessee, *Water supply, *Water utilization, *Water demand, Rivers, Streams, Surface waters, Groundwater, Water resources, Water resources development, Natural resources, Legal aspects, Riparian rights, Water requirements, Water users, Human population, Industrial use (Water), Hydroelectric power, Aquifers.

Summarizing the total water use in Tennessee in 1964, this report illustrates through the use of tables and graphs the amount of water used, the sources of the water, and the allocation of water between agricultural, industrial, municipal, and domestic users. Tables are broken down into county-by-county and user-by-user figures. The percentage of available water withdrawn from each major river basin is also graphed. The report also points out some legal aspects of water use in Tennessee, including the requirement that large quantity users register with the State Division of Water Resources. Tennessee follows the riparian rights doctrine except that, contrary to the general rule, one decision has permitted withdrawal for municipal purposes. (Liptak-Florida)
W71-04324

6E. Water Law and Institutions

THE LEGAL SYSTEM: STRUCTURE OR CONSTRAINT FOR SYSTEMS ANALYSIS DECISION-MAKING,
Indiana Univ., Bloomington. School of Law.
A. Dan Tarlock.
In: Natural Resource Systems Models in Decision Making, Lafayette, Indiana, Water Resources Research Center, Purdue University, p 179-190, 1970. 9 ref.

Descriptors: *Legal aspects, *Institutional constraints, *Decision making, *Water resources development planning, Systems analysis.
Identifiers: *Legal system, Physical system, Public engineering decisions.

There are fundamental differences between the legal and the physical systems approaches to water resources development. Legal decisions are characterized by: concern with past events, concern with a few parties, the settlement of disputes; the incidental and temporary, unpredictable results, immediate solutions and indirect long range solutions. In contrast, public engineering decisions are characterized by: concern with future events, concern about all parties, the prevention of disputes, the optimal and semi-permanent, more predictable results, deferred solutions, and direct long range solutions. These distinctions are illustrated by considering how the legal and physical systems affect decisions in three areas: allocation of scarce resources, drainage and flooding, and environmental quality. The fundamental dissimilarities that characterize water resources law often provide constraints for the physical and economic system. Yet the interaction of these systems generates changes. On the one hand, legal structures are created conducive to implementing systems analysis solutions. On the other hand, legal developments force incorporation of broader alternatives into physical systems analysis. (See also W71-03855) (Davis-Chicago)
W71-03865

CONDITIONS OF LEGAL AND POLITICAL FEASIBILITY,
Indiana Univ., Bloomington. Dept. of Political Science.
Vincent Ostrom, and Elinor Ostrom.
In: Natural Resource Systems Models in Decision Making, Lafayette, Indiana, Water Resources Research Center, Purdue University, p 191-208, 1970. 3 fig, 15 ref.

Descriptors: *Legal aspects, *Political aspects, *Water resources development, *Feasibility, *Decision making, Optimization, Evaluation, Institutions, Planning, Economic feasibility, Financial feasibility, Technical feasibility.
Identifiers: Decision rules, Management systems.

If programs of action in the field of water resource development are to be successful, they have to satisfy technical, economic, financial, legal, and political criteria. Often there is a large array of alternative solutions each producing 'goods' and 'bads' where these terms stand for the broadest possible interpretation of 'benefits' and 'costs'. Maximizing the production of 'goods' is guided by constraints that derive from decision rules of conduct. Law is the prime example of such a set of decision rules. In solving total water resources problems, however, rules become uncertain and the associated politics are a game played under rules that change during the game. Therefore, applied political theory must allow for changes in rules, players, values, and utility functions and their associated probabilities. Water resource decision making involves evaluation of legal and political rules, risks, and opportunities by a team of engineers and lawyers cooperating to suggest needed institutional arrangements. Water resources involve a very complex bundle of goods. Legal relations reflect this, e.g., by the presence of more than one doctrine of water rights. The relation between property right and public authority is particularly relevant in the design of management systems. Such systems often require the institution of new decision rules as condition of long-run political feasibility. The use of a coastal acquifer in Southern California is used as a case study. (See also W71-03855) (Davis-Chicago)
W71-03866

INSTITUTIONAL DESIGN FOR WATER QUALITY MANAGEMENT: THE IMPLICATIONS OF A SYSTEMS APPROACH FOR LEGAL AND ADMINISTRATIVE ARRANGEMENTS,
Wisconsin Univ., Madison. Dept. of Regional Planning.
Irving K. Fox.
In: Natural Resources Systems Models in Decision Making, Lafayette, Indiana, Water Resources Research Center, Purdue University, p 209-221, 1970. 4 fig, 3 ref.

Descriptors: *Institutions, *Water quality, *Systems analysis, *Legal aspects, *Administration, Institutional constraints, Evaluation, Regulation, Economics of scale.
Identifiers: *Water quality management, *Legal-administrative reform, Subsidies.

Relatively recent changes in legal-administrative water arrangements have not yet resulted in conditions under which the systems approach can be properly applied and its decision results implemented. The nature of this problem is illustrated with several examples. Legal-administrative arrangements, conducive to implementing systems analysis results, should incorporate two groups of attributes. The first group includes: (a) technical competence to isolate efficient systems and alternatives; (b) ability to elicit process changes by industry; and (c) capacity to operate joint system components. While at present no agency has all these attributes, they are probably easier to realize than the capabilities of the second group. These include: (a) setting of standards; and (b) evaluating their costs as to magnitude and distribution. The implications of the systems approach for legal-administrative reform are: (a) avoid general subsidies that encourage economies of scale; (b) decrease reliance on regulation of individual discharges; and (c) ascertain the production functions of industries relative to water process changes. (See also W71-03855) (Davis-Chicago)
W71-03867

RECOMMENDATIONS CONCERNING PROPOSED LEGISLATION TO AUTHORIZE WATER MANAGEMENT DISTRICTS IN FLORIDA.
Cornell (Maurice H.) and Associates, Miami, Fla.

Recommendations Concerning Proposed Legislation To Authorize Water Management Districts in Florida, Department of Water Resources, State of Florida, Nov 1960. 20 p, 3 fig.

Descriptors: *Florida, *Legislation, *Water management (Applied), *Water districts, Local governments, State governments, Federal government, Drainage, Drainage districts, Administrative agencies, Legal aspects, Taxation, Administration, Planning, Regulation, Institutions, Governments, Management.

Recommendations by a commercial engineering firm for legislation authorizing water management districts in Florida, this report emphasizes that: (1) new legislation should be applicable to any state area, (2) local government should have a strong voice in planning and operation, (3) taxation to finance water district operations should be commensurate with the benefit derived, and (4) legislation should not be patterned after that of other states. Specific proposals are made for legislation creating water management districts and sub-districts, and regulating their relations with local government. The purposes, powers, duties, and organization of the proposed districts are included, along with provisions for dealing with federal agencies. Charts illustrate the organizational links between the state and local levels of the proposed water district system. The report's conclusion emphasizes the necessity for carefully drafted legislation to enable Florida to meet its water problems. (Hart-Florida)
W71-03878

WATER RIGHTS LAW AND MANAGEMENT IN WEST VIRGINIA -- FUTURE NEEDS AND ALTERNATIVES,
West Virginia Center for Appalachian Studies and Development, Morgantown.
Marlyn E. Lugar.
Water Rights Law and Management in West Virginia--Future Needs and Alternatives, Office of Research and Development of the West Virginia Center for Appalachian Studies and Development, West Virginia University, Public Affairs Series No 4 (May 1967). 50 p, 38 ref.

Descriptors: *West Virginia, *Water law, *Water utilization, *Non-structural alternatives, Riparian rights, Water management (Applied), Administration, Legal aspects, Water rights, Water policy, Judicial decisions, Legislation, Prior appropriation, Preferences (Water rights), Regulation, Watershed management, Surface waters, Streams, Watercourses (Legal), Groundwater, Hydrologic cycle, Riparian waters, Riparian land, Future planning (Projected).

Dealing with water rights law and management in West Virginia, this paper: (1) explains why water

shortages may occur in West Virginia, (2) examines the legal rights to the water which is available, and (3) suggests certain changes in the water-use law. It is argued that development of sound principles of law to regulate the use of surface and groundwater must recognize the hydrologic cycle. West Virginia case law has adopted the riparian rights doctrine, but has not applied it to the use of surface water. The paper surveys various aspects of the doctrine as applied to both surface and underground streams, including: (1) uses by riparian owners, (2) uses on riparian tracts, (3) uses by municipalities, (4) rights of riparian owners, (5) what is reasonable use, and (6) investments under the doctrine. The author recognizes a need for watershed management in West Virginia and notes that the existing West Virginia water-use law should be re-examined. A model program is the Huron River Watershed in Michigan. Standards for regulation of water use should be determined by the legislature based on public policy. A major weakness in the current West Virginia law as to water in streams is that it does not fix with certainty the extent of the rights to use water therefrom. (Powell-Florida)
W71-03880

RIGHTS TO SURFACE AND SUBSURFACE WATER IN MASSACHUSETTS.
Legislative Research Council of Massachusetts.

Commonwealth of Massachusetts Senate Report No 695, Submitted by the Legislative Research Council Relative to Rights to Surface and Sub-Surface Water in Massachusetts, Feb 13, 1957. 124 p, 7 fig, 6 tab, 20 append.

Descriptors: *Massachusetts, *Water law, *Surface waters, *Subsurface waters, Water rights, Water resources, Riparian rights, Water supply, Groundwater, Water pollution, Floodwater, Navigable waters, Fish, Wildlife, Recreation, Water resources development, Drainage, Water utilization, Rainfall, Administrative agencies, Judicial decisions, Water storage, Industrial water, Public rights.

Prepared by the Legislative Research Council of Massachusetts as a guide to the Water Resources Commission, this report examines: the state of water law in Massachusetts, present and future demands for water supplies, problems of water pollution, and water resources management. The report limits itself to statistical research and fact-finding and does not make recommendations or legislative proposals. Chapter headings include: (1) Water Law in Massachusetts, (2) Riparian Doctrine and Water Resources, (3) Present and Future Water Uses, (4) Industry, (5) Agriculture, (6) Recreation, (7) Hydroelectric Power and Navigation, (8) Flood Control, (9) Pollution, (10) Groundwater, (11) Management Programs in Massachusetts and Other States, and (12) Problems Ahead. Considerable attention is given to water supply, demand, use, consumption and waste. The riparian doctrine receives broad treatment as the basis of Massachusetts water law. There is an examination of case law and legislation in the area of water law and, in an appendix, a digest of leading Massachusetts cases. Attention is also given to various federal and state programs. (Duss-Florida)
W71-03882

IN RE CITY OF YONKERS (CONDEMNATION VALUE OF RIPARIAN LAND).
225 NYS 181 (Sup Ct App Div 1927).

Descriptors: *New York, *Beds under water, *Condemnation, *Compensation, Riparian rights, Riparian land, Eminent domain, Legal aspects, Judicial decisions, Land, Real property, Ownership of beds.

In a condemnation proceeding, the Supreme Court of New York held per curiam that a riparian owner's right to apply for a grant of submerged lands is not 'property' requiring compensation under the constitution. (Hart-Florida)
W71-03883

NEW HORIZONS IN WATER RESOURCES ADMINISTRATION,
Resources for the Future, Inc, Washington, D.C.
Irving K. Fox.
New Horizons in Water Resources Administration, Resources for the Future, Inc, Washington, DC, April 1965. 8 p, 31 ref.

Descriptors: *Investment, *Administrative agencies, *Water resources development, *Cost-benefit analysis, Federal government, Cost-benefit ratio, Economics, Feasibility studies, Project planning, Cost-benefit theory, Costs, Cost repayment, Cost analysis, Administrative decisions, Interest, Interest rate, Debt, Financing, Financial analysis, Administration, Institutional constraints, Political aspects, Water management (Applied).

Two means of improving administration of water resources are considered in this review: continual evaluation of cost-benefit ratios of water resources projects, and a checks-and-balances framework for administrative agencies to promote efficiency. The author's basic premise is that feasibility of water resources projects depends upon whether benefits exceed costs. He presents six factors to be considered in evaluating water resource investments: (1) the interest required to be paid for public investment; (2) secondary benefits, or those indirectly derived; (3) the difficulty of valuing some development, such as scenery; (4) the range of alternatives other than water to accomplish the desired end; (5) future projections of usefulness of the project; and (6) the multitude of variables influencing the project. Three methods of improving the efficiency of administrative agencies are examined: (1) use of market-like signals as inducement for agencies to act in the public interest; (2) restructure of administrative organization to permit politically responsible administrative action; and (3) use of counter-vailing arrangements to foster efficiency. (Hart-Florida)
W71-03887

MENTELSON V STATE (LIABILITY FOR FLOOD DAMAGE RESULTING FROM STATE'S OBSTRUCTION OF DRAINAGE CHANNEL).
218 App Div 210, 218 NYS 223-229 (Sup Ct App Div 1926).

Descriptors: *New York, *Spoil banks, *Dam failure, *Canal embankments, Flood damage, Dams, Canals, Drainage, Buildings, Walls, Obstruction to flow, Rain, Storm runoff, Surface runoff, Water injury, Adjudication procedure, Legal aspects, Judicial decisions, Damages, State governments, Precipitation excess, Canal construction, Historic flood.

Plaintiff building owner sued defendant state for damages caused by the collapse of plaintiff's building. Defendant had canalized a river, depositing the spoils alongside the river, and the spoilbank obstructed a drainage channel which flowed near plaintiff's building. After an extraordinary but not unprecedented rainfall, which broke a dam upstream from plaintiff's building, flooding caused by the obstructed outlet undermined plaintiff's building. Defendant contended that the breaking of the dam was the proximate cause of the injury. The Supreme Court of New York stated that: (1) defendant had the burden of proving that other causes created plaintiff's loss; (2) defendant's liability was identical to that of an individual; and (3) defendant would be liable notwithstanding the extraordinary character of the flood. Holding that defendant had created a nuisance by erecting the spoil bank, the court adjudged defendant liable for plaintiff's loss. (Hart-Florida)
W71-04018

KENTUCKY WATER RESOURCES 1965 (SUMMARY OF INFORMATION INVOLVING KENTUCKY'S WATER RESOURCES).
Kentucky Dept. of Natural Resources, Frankfort.

Kentucky Water Resources - 1965, Commonwealth of Ky, Frankfort, Ky (June 1965). 79 p, 12 fig, 13 map, 9 photo, 19 tab.

Descriptors: *Kentucky, *Water resources, *Administrative agencies, *Legal aspects, State governments, Water resources development, Hydrologic cycle, Water conservation, Water supply, Federal government, United States, Legislation, Judicial decisions, Local governments, Water requirements, Surface waters, Surface-groundwater relationships, Groundwater, Surface runoff, Water quality, Water utilization, Climatic data, Water pollution.

Current information relating to the status of Kentucky's water resources is presented in this report. It is divided into eight chapters: (1) climate, (2) population, (3) water use, (4) water quality, (5) surface water, (6) groundwater, (7) water rights and regulatory laws, and (8) existing programs and administration. Chapter 7 discusses: (1) the constitutional origin of the development of Kentucky water resources, (2) case law on water rights, (3) state regulatory authorities, and (4) federal regulatory authorities. In Chapter 8 state departments involved in water resources management are discussed, including: (1) the Departments of Natural Resources; (2) the Division of Flood Control and Water Resources Development; (3) the Strip Mining and Reclamation Commission; (4) the Division of Forestry; (5) the Division of Soil and Water Resources; (6) the Division of Cleanup and Beautification; (7) the Department of Fish and Wildlife Resources; (8) the Department of Parks; (9) the Department of Public Safety; (10) the Department of Health; (11) the Kentucky Geological Survey; (12) the Department of Mines and Minerals, (13) the Water Resources Institute; and (14) the Department of Commerce. Activities of state boards, districts, political subdivisions, interstate agencies, US government agencies, and private organizations are also examined in Chapter 8. (Hart-Florida)
W71-04021

PRINCIPLES OF WATER RIGHTS LAW IN OHIO,
Ohio Dept. of Natural Resources, Columbus. Div. of Water.
Charles C. Callahan.
August, 1959. 34 p, 2 chart, 299 ref.

Descriptors: *Ohio, *Preferences (Water rights), *Water law, *Water rights, Judicial decisions, Legal aspects, Surface-groundwater relationships, Surface waters, Surface runoff, Percolating water, Underground streams, Subsurface flow, Water pollution, Riparian land, Riparian waters, Consumptive uses, Diversion losses, Reasonable use, Floodwater, Drainage water, Civil law, Irrigation, Underseepage, Legislation, Groundwater.

The legal classifications, general theories, and nature of the problems existing in Ohio water law are examined in this study. Water rights law is discussed from the vantage point of judicial decisions rather than specific legislative provisions. The doctrine of riparian rights, water uses, alternative dispositions of water, and water pollution are considered in their relationship to streams and rivers. Diffused surface water is studied in its relationship to other waters, its possible uses, and the legal consequences created by varying types of surface water. Legal aspects of underground water supplies, including both percolating water and underground streams, are discussed by the author in terms of the consequences of malicious use, negligence, subsidence of surface areas, decreased streamflow, and pollution. Specific doctrines considered in the work include: (1) prior appropriation, (2) riparian rights, (3) natural flow, (4) reasonable use, (5) common enemy, and (6) civil law. (Earl-Florida)
W71-04022

THE DOCTRINE OF CONSEQUENTIAL LOSS AS AFFECTED BY VALUATION FORMULAS,
Robert P. Schuster.
Land and Water Law Review, Vol 4, No 2, p 539-557, 1969. 19 p, 57 ref.

Descriptors: *Condemnation value, *Eminent domain, *Condemnation, *Damages, Land appraisal, Land, Real property, Governments, Legal aspects, Judicial decisions, Economics, Land use, Land resources, Urbanization, Cost analysis, Analysis, Appraisals, Costs, Evaluation, Benefits, Cost allocation, Value, Compensation, Economic impact.

The author of this comment advocates restricting the doctrine of consequential loss, a doctrine which denies compensation to a condemnee for the taking of rights so remote as to be incidental to the condemnation of physical property. The elements governing compensability in condemnation proceedings are stated to be: (1) property; (2) taking; and (3) just compensation. As any one of these elements becomes more loosely defined, those instances in which the doctrine may be imposed become fewer. The concept of 'taking' has become broad enough that land flooded by a dam may be found to have been appropriated, requiring compensation. Attention is given the legal development of the doctrine and the equitable considerations mitigating for its restriction. Special emphasis is placed on the land use considerations suggesting restriction of the doctrine. The author contends that a doctrine of compensation for only what is physically taken, rather than what the condemnee actually uses, leads to inefficient land use. The author proposes that more protection be afforded the expectations and reliance interests of condemnees. (Dye-Florida)
W71-04031

CORCORAN V VILLAGE OF BENNINGTON (RIGHT TO WATER AND SEWER SERVICE PERMITS).
266 A2d 457-466 (Vt 1970).

Descriptors: *Vermont, *Water permits, *Zoning, *Permits, Land use, Water delivery, Sewers, Local governments, Administrative decisions, Public rights, Land tenure, Real property, Legislation, Judicial decisions, Legal aspects, Land classification, Land development.
Identifiers: Injunction (Mandatory).

Plaintiff mobile-home subdivision owner sought to compel defendant village authorities to issue permits for water and sewer service. Defendants had failed to act on plaintiff's application for several years. Plaintiff contended he was entitled to the permits applied for plus a court order requiring the future issuance of such permits, notwithstanding a zoning ordinance enacted subsequent to his application and excluding mobile-home subdivisions. Defendants, relying on an earlier zoning ordinance which also barred such subdivisions, contended that their refusal to act was within their discretionary powers. Stating that sewer and water services are a matter of right which may not be used as zoning instruments, the court held that mobile home subdivision owners are entitled to sewer and water service under the same terms and conditions as other residents. After finding invalid the zoning ordinance in effect at the time of plaintiff's application, the court ordered defendants to grant the permits previously applied for. However, the court refused to compel the issuance of future permits since such permits are subject to reasonable regulations, and the court would not prejudge defendants' actions in imposing such regulations. (Earl-Florida)
W71-04071

HYDRAULIC RACE CO V GREENE (INTERPRETATION OF LEASE PROVIDING FOR USE OF ALL SURPLUS WATERS OF CANAL).

230 App Div 374, 245 NYS 444-461 (Sup Ct 1930).

Descriptors: *New York, *Leases, *Contracts, *Canals, Industries, Legal aspects, Judicial decisions, Water rights, Adjudication procedure, Relative rights, State governments, Governments, Water contracts, New York State Barge Canal, Transportation, Water sources, Channel flow, Navigation.
Identifiers: Patents (Land).

The state leased to plaintiff waters of the Erie Canal under a contract which allowed plaintiff the use of all waters of the canal not needed by the state for navigation. Defendant superintendent of public works sought to interfere with plaintiff's use of the waters, contending that the maximum quantity of water leased to plaintiff was that amount not necessary for navigation at the time of the execution of the contract. Plaintiff sought to restrain defendant's interference. The Supreme Court of New York reversed an official referee's judgment for defendant. Contracts for consideration, involving the state as lessor of surplus canal waters, should be construed favorably to the patentee. Effect must be given to the mutual intent of the parties. In this case the contract leased all waters not necessary for navigation, not merely surplus waters existing at the time of the contract's execution. When enlargement of the canal increased the surplus, plaintiff was entitled under the lease to the entire surplus amount. (Dye-Florida)
W71-04074

WYKLE V COLOMBO (APPORTIONMENT OF ACCRETIONS BETWEEN ADJACENT RIPARIAN OWNERS).

457 SW2d 695-701 (Mo 1970).

Descriptors: *Missouri, *Accretion (Legal aspects), *Boundary disputes, *Adjudication procedure, Boundaries (Property), Riparian land, Rivers, Navigable rivers, Navigable waters, Banks, Riparian waters, Land tenure, Real property, Prescriptive rights, Docks, Recreation facilities, Legal aspects, Judicial decisions, Surveys, Mapping.

Plaintiff riparian owner brought action against adjacent riparian owner to establish title by advserse possession to certain land to which defendant held record title. Affirming a judgment for defendant, the Supreme Court of Missouri noted that the trial court was correct in not partitioning the land formed by accretion along the river bed bounding the property of the parties. The court held that plaintiff's petitions and exhibits contained insufficient information to enable the trial court to properly determine the boundaries and to apportion the accreted land between the adjoining riparian owners. (Liptak-Florida)
W71-04078

POWER OF CITIES AND TOWNS TO PROVIDE DRAINAGE AND SEWAGE FACILITIES.
Iowa Code Ann secs 368.26, 368.43 thru 368.46 (Supp 1969).

Descriptors: *Iowa, *Cities, *Drainage systems, *Sewage disposal, Public health, Sewage, Sewage treatment, Drains, Surface waters, Drainage, Surface drainage, Contracts, Legislation, Assessment, Floodwater, Local governments, Government finance, Supervisory control (Power), Sewage districts.

Governments of cities and towns shall have the power to provide drainage systems for flood and other surface waters and to regulate connection of private drains thereto. Municipalities may order connections from private property when public health and safety require and may have such works done if their order is not complied with. Municipal governments shall also have the power to provide sewer systems and sewage disposal plants, and may regulate sewer connections to private property. They may order installation of sanitary toilet facilities on property abutting a sewer line, and may cause the work to be done and assess costs if their orders were not complied with. Also included are provisions regarding extension of sewer systems and powers of cities to enter into contracts with sewage disposal operators outside corporate limits. All cities with populations of more than 100,000, through which a stream flows furnishing drainage for any adjoining cities upstream, shall have the power to construct the drains and sewers necessary to protect the public health. Various procedural sections are included, outlining procedures to be complied with in the construction of sewers and establishment of sewer districts. (Duss-Florida)
W71-04081

THE DELAWARE RIVER BASIN COMPACT--AN ALTERNATIVE FOR IMPLEMENTING WATER RESOURCES MANAGEMENT (ORGANIZATION, OPERATION, AND RESULTS OF THE BASIN COMPACT),
J. W. Thursby.
Address, Southern Water Resources Conference, 15th Meeting, Tulsa, July 16-18, 1969, p 11-19. Council of State Governments, Atlanta, Ga. Southern Office.

Descriptors: *Delaware River Basin Commission, *Water resources development, *River basin development, *Interstate compacts, Water utilization, Delaware River, Interstate rivers, Delaware, New York, New Jersey, Pennsylvania, Conservation, Governments, Interstate commissions, Nonstructural alternatives, Project purposes, Water conservation, Water policy, Water supply, Water pollution control, Watershed management, Public utilities, Recreation facilities, Reservoirs, Flood control.

Presented at a meeting of the Southern Water Resources Conference, this address outlines the authority, responsibilities, duties, administrative arrangements, results, and continuing problems of the Delaware River Basin Commission. The Commission is responsible for water resource development in the Delaware River basin and was created by the Delaware River Basin Compact signed by Delaware, New York, New Jersey, and Pennsylvania. After outlining the background, organization, and operations of the Commission, the text discusses program successes in the areas of: water supply, in incorporating storage and flow control facilities, in water quality, and in setting waste discharge standards for river zones and individual dischargers. The speaker briefly mentions problems and projects relating to flood control, watershed management, recreation facilities, rehabilitation of fish and wildlife resources, and promotion of hydroelectric power resources. The text concludes that the interstate compact is an effective approach to water resources development because of its broad scope and powers. The need for additional legislation to deal with particular problem areas is cited. (Liptak-Florida)
W71-04089

THE PROPOSED POTOMAC RIVER BASIN COMPACT,
Julian M. Alexander.
Address, Southern Water Resources Conference, 15th Meeting, Tulsa, July 16-18, 1969, p 5-10. Council of State Governments, Atlanta, Ga. Southern Office.

Descriptors: *River basin commissions, *Water resources development, *River basin development, *Interstate commissions, Water utilization, Legislation, Water pollution control, Water quality control, Flood protection, Administration, Administrative agencies, Coordination, Project planning, Legal aspects, Adjudication procedure, Maryland, Virginia, West Virginia, Pennsylvania, District of Columbia, Watershed management, Multiple-purpose projects, Water policy, Water supply, Interstate compacts.
Identifiers: *Potomac River Basin Commission.

Presented at a meeting of the Southern Water Resources Conference, this address outlines the organization, powers, and purposes of the proposed Potomac River Basin Commission. The Commission is to be created by an interstate compact to be

signed by Maryland, Virginia, West Virginia, Pennsylvania, and the District of Columbia. The basin-wide commission would cooperate with and coordinate the individual agencies already responsible for pollution abatement, flood prevention, watershed management, scenic and recreational development, and water supply. The text outlines the problems and responsibilities of the proposed Commission in each of these areas. The Commission will have authority for research and planning, but actual implementation and construction will be left to the already existing agencies under Commission coordination and supervision. The author points out that the commission will be accountable to the public and its actions subject to judicial review. (Liptak-Florida)
W71-04090

THE POLITICS OF WATER,
Council of state Governments, Atlanta, Ga. Southern Office.
Tom Adams.
Address, Southern Water Resources Conference, 14th Meeting, Miami Beach, July 31-Aug 2, 1968, p 16-19.

Descriptors: *Political aspects, *Water resources development, *Non-structural alternatives, *Water allocation (Policy), Governments, Inter-agency cooperation, Planning, Government finance, Water policy, Legislation, Regulation, Water Resources Research Act, Flood control, Water conservation, Water utilization, Water supply, Inter-basin transfers, Interstate commissions, Water Resources Planning Act.

Presented at a meeting of the Southern Water Resources Conference, this speech distinguishes between two types of water problems: (1) practical problems, technical solutions to specific problems; and (2) political problems, generation of public interest and financing to implement the practical solutions. The author considers the three most pressing political problems to be: (1) comprehensive state and interstate water resources inventory and planning, (2) inter-basin transfer of water supplies, and (3) regulation of water use to guarantee equal access to the available water supply. The text concludes that all of these problems are within present technological capabilities, but that none can be solved without political and public support for the financial and administrative programs necessary to implement the available technology. (Liptak-Florida)
W71-04091

A NATIONAL POLICY FOR THE ENVIRONMENT: SELECTED EXCERPTS FROM THE CONGRESSIONAL RECORD AND CONGRESSIONAL DOCUMENTS, FALL, 1969, 91st CONGRESS. 1st SESSION.
Library of Congress, Washington, D.C. Legislative Reference Service.

Part I, December 1969. 156 p; Part II, January 1970. 24 p. TP450.

Descriptors: *Federal government, *Environment, *Legislation, *Federal project policy, Conservation, Administrative agencies, Ecology, Environmental effects, Natural resources, Wildlife, Aquatic life, Water supply, Water pollution, Pollution abatement, Air pollution, Oceans, Water policy, Public health, Beneficial use, Fresh water, Waste disposal, Balance of nature, Administration, Leadership, Research and development.
Identifiers: *National Environmental Policy Act.

Tracing the history of the National Environmental Policy Act of 1969, these selected excerpts from the Congressional Record and from congressional documents include: (1) debate on Senate Bill 1075, to establish a national policy for the environment; (2) debate on Senate Bill 7, to amend the Federal Pollution Control Act; (3) debate on House Resolution 12549, to amend the Fish and Wildlife Coordination Act for establishment of a Council on Environmental Quality; (4) Senate Report 91-296 accompanying Senate Bill 1075; (5) debate on the Conference Report on Senate Bill 1075; and (6) Public Law 91-190, the National Environmental Policy Act of 1969. The overriding concern of the debates was the use of environmental management to bring about improvement in the quality of the environment. The existing governmental organizations were seen as inadequate to cope with the complexity of environmental problems, thus creating a need for a national policy and a council on Environmental Quality. Prominent consideration was given to research and investigations into: ecological systems, natural resources, and the quality of the environment. (Duss-Florida)
W71-04092

DELAWARE RIVER BASIN COMPACT.

Delaware River Basin Commission, Trenton, January 1967. 51 p, 1 map.

Descriptors: *Delaware River Basin Commission, *Delaware River, *Interstate compacts, *Water resources development, United States, Pennsylvania, Delaware, New York, New Jersey, Legislation, Interstate rivers, Interstate commissions, navigable rivers, Riparian rights, Hydroelectric power, Federal government, State governments, Administrative agencies, Water pollution, Flood protection, Watersheds, Watershed management, Taxes, Water pollution control.

The Delaware River Basin Compact of 1961 between Delaware, New Jersey, Pennsylvania, New York and the United States is supervised by the Delaware River Basin Commission. The purpose of the Compact is to provide for cooperation among the signatory states in developing and utilizing the water resources of the Delaware River. Article 2 creates the commission and establishes its composition, procedures, and jurisdiction. The Commission's power and duties are promulgated in Article 3. Article 4 authorizes the Commission to supervise water supply from the Delaware. Provisions are made for storage, release of waters, and assessable improvements. The Commission also is given full power over: (1) pollution control, (2) flood protection, (3) watershed management, (4) recreation, (5) hydroelectric power, and (6) withdrawals and diversions. Article II provides for intergovernmental relations. Other articles provide for capital financing, plans, programs, and budgets. General provisions for such things as tax exemptions, oaths of office, insurance, condemnation proceedings, tort liability, and riparian rights are promulgated in Article 14. Part II of the Compact deals with effectuation and publishes the ratifying acts of the legislatures of the signatory states. (Hart-Florida)
W71-04093

INFORMATION FOR APPLICANTS FOR CONSTRUCTION, ALTERATION, OR REPAIR OF DAMS.
New Jersey Department of Conservation and Economic Development, Trenton, 1958. 28 p, 7 plate.

Descriptors: *New Jersey, *Dams, *Legislation, *Permits, Administrative agencies, Dam construction, Dam design, Dam foundations, Earth dams, Damsites, Design flood, Spillways, Hydrologic data, State governments, Legal aspects, Engineering, Engineering structures, Governments, Administration.

Information required for dam building and repair in New Jersey is furnished by this pamphlet. The New Jersey statutes pertaining to dams and obtaining permits to construct or repair dams are set forth in full at the beginning. The statutes are followed by general information for applicants, stating that the following data must accompany each application: (1) location plan, (2) general site plan, (3) engineering report, (4) construction drawings, and (5) technical specifications. The engineering report requirements are next set forth in detail followed by a guide outline for site investigation. In order to make a rational determination of the required spillway capacity, the type, design criteria for them are suggested. The pamphlet lists and describes the usual types of spillways utilized in New Jersey: (1) overfall, (2) ogee, (3) chute, (4) auxiliary, and (5) siphon or gated. A formula for calculating the discharge capacity of a spillway is provided. Further information includes: (1) requirements for drawings submitted with applications, (2) standard conditions to which all permits are subject, and (3) a series of specimen drawings. (Hart-Florida)
W71-04094

RIPARIAN AND LITTORAL RIGHTS; A SURVEY OF SOME OF THE LEGAL PROBLEMS INVOLVED IN RESIDENTIAL AND COMMERCIAL USES ALONG THE WATER'S EDGE IN RELATION TO THE SUBSTANTIVE ASPECTS OF PUBLIC POLICY,
Carroll Dunscombe.
William-Frederick Press, New York, 1970. 84 p, 54 ref.

Descriptors: *Riparian land, *Riparian rights, *Littoral, *Land use, Rivers and Harbors Act, Submerged Lands Act, Water law, Federal government, United States, Prescriptive rights, Diversion, Navigation, Relative rights, Remedies, Water pollution, Drainage, Islands, Competing uses, Oceans, Gulfs, Fishing, Swimming, Accretion (Legal aspects), State governments, Florida, Legal aspects.

Since the average riparian or littoral owner has only a vague idea of his property rights and what he may do without encountering legal difficulties, this book endeavors to delineate these rights and indicate the rights to which they may be subject. Littoral property is distinguished from riparian land by its location on an ocean or gulf. In this survey of the legal difficulties of riparian and littoral land use, both residential and commercial, subdivisions discuss: (1) source of the riparian right; (2) nature, extent, and basis of the right; (3) property to which rights attach; (4) deprivation of navigability through water diversion; (5) reducing the right to possession; (6) islands; (7) loss of the riparian right; (8) adverse possession; (9) extent of the right to view; (10) pollution; (11) the public's right to fish and bathe; (12) the right of navigation; (13) the Rivers and Harbors Act; (14) drainage; (15) trespass on the right; (16) prescriptive rights; (17) accretion and reliction; (18) state control; (19) Florida attempts to revoke the riparian right grant; (20) federal control; (21) water conservation districts; and (22) the Tidelands decision and the Submerged Lands Act. (Hart-Florida)
W71-04095

ACTIVITIES OF THE FEDERAL WATER POLLUTION CONTROL ADMINISTRATION--WATER QUALITY STANDARDS.
Hearings--Subcomm On Air and Water Pollution--Comm on Public Works, US Senate, 90th Congress, 2nd Session, Mar 27, 1968. 296 p, 5 fig, 1 map, 11 photo, 47 ref, 4 append.

Descriptors: *Adminstrative agencies, *Water Quality Act, *Water quality, Federal government, Standards, Water pollution, Water pollution control, Water quality control, Administration, Legislation, Water policy, State governments, Wastes, Waste treatment, Effluents, Estuaries, Costs, Cost analysis, Manpower, Technology, Sewage treatment, Municipal wastes, Industrial wastes, Management, Financing.
Identifiers: *Federal Water Pollution Control Act.

The Senate Subcommittee on Air and Water Pollution held these hearings on the activities of the Federal Water Pollution Control Administration (FWPCA) in the area of water quality standards. The purpose of the hearings was to provide background for future hearings on pending legislative proposals. Existing legislation involved in the

consideration of FWPCA activities included: (1) the Water Quality Act of 1965, which created the FWPCA; (2) the Clean Water Restoration Act of 1966; and (3) the Federal Water Pollution Control Act. Members of the Department of the Interior were the principal witnesses testifying before the subcommittee. The basic duty of the FWPCA is the protection and restoration of the nation's waters. Principles governing the Administration's review of water quality standards are discussed. The most significant objective of the Administration is preventing degradation of existing water quality. Other areas receiving attention include: (1) construction grants for waste treatment works, (2) cost studies of waste treatment facilities, (3) manpower and training requirements to carry out programs, (4) enforcement of water quality standards, and (5) pollution of estuaries. A state-by-state analysis of bond issues for sewer and waste treatment facilities is included, as is an article on municipal sewer service charges. Appendixes outline state water quality standards and FWPCA activities. (Duss-Florida)
W71-04096

THE LAND AND WATER CONSERVATION FUND ACT: DEVELOPMENT AND IMPACT,
Central Washington State Coll., Ellensburg. Dept. of Geography.
Kenneth A. Hammond.
1969. 249 p, 13 tab, 174 ref. OWRR Project B-019-WASH (2).

Descriptors: *Recreation demand, *Legislation, *Water allocation (Policy), *Federal project policy, Federal jurisdiction, State jurisdiction, Federal government, State government, Land classification, Administrative decisions, Inter-agency cooperation, Administrative agencies, Adoption of practices, Project purposes, Political constraints, Institutional constraints, Washington, Political aspects, Economic impact, Recreational facilities, Legal aspects, Land use, Water resources, Social impact, Water conservation.
Identifiers: *Land and Water Conservation Fund Act of 1965.

Focusing on the Land and Water Conservation Fund Act of 1965, this study compares the congressional decisions to commit land and water resources to specified use patterns to the results in fact achieved by such legislation. The evolution, impact, and future significance of the LWCP Act experience are evaluated through an analysis of: (1) intergovernmental and organizational relationships, (2) decision-making processes, and (3) economic and political realities. Part I of the study considers the federal response to those public recreational preferences which resulted in the LWCF. Part II examines the response of states to the LWCF program. The state of Washington's attempts to meet public recreational demands, the influence of the LWCF on Washington's programs, and the role of state agencies, policies, and procedures are discussed in Part III. In Part IV, common factors in the state and federal experience with the LWCF are considered in terms of program objectives and operating methods. Also considered are such problems as: financing, zoning, assessment, easements, planning, staffing, taxing, federal-state division of revenues, and appropriations in the area of resource policy. (Earl-Florida)
W71-04097

DEVELOPMENT OF OCEAN SPACE--AN INTERNATIONAL DILEMMA,
Arvid Pardo.
Louisiana Law Review, Vol 31, No 1, p 45-72, 1970. 28 p, 32 ref.

Descriptors: *Oceans, *International law, *Natural resources, *Law of the sea, Beds, Legal aspects, International waters, Commercial fishing, United Nations, Governments, Foreign waters, Foreign countries, United States, Conservation, Beds under water, Regimes, Ownership of beds, Boundaries (Property), Continental shelf, Water pollution, Pollution abatement, Water pollution control, Non-structural alternatives, Relative rights.
Identifiers: *Ocean resources.

Discussing the problem of controlling the depletion of the natural resources of the high seas, this article points to increasing pollution and fish stock depletion as examples of the fallacy in the existing international law philosophy, that is, that the seas' resources are inexhaustible. The present law says nothing about the seabed other than the continental shelf itself. The author proposes a shift of emphasis in international law from settling internation disputes to establishing guidelines for the protection and development of the oceans' resources. He suggests an independent international agency to serve as trustee of the oceans' resources and to allocate and manage development rights in the ocean floor. The author also discusses the difficulties in obtaining United Nations action, specifically the failure to agree on basic legal principles governing exploitation of the sea beds. The difficulty centers on the failure to agree on three basic questions: (1) the basic concept, whether to retain the idea of the freedom of the high seas or to adopt a common heritage-public trust approach; (2) the nature of the international regime, whether its competence should be limited to specific resources or extended to control of all ocean uses; and (3) the definition of the limits of national jurisdiction. The author concludes that early action is vital since the oceans' resources continue to be depleted while coastal states haggle over national objectives. (Liptak-Florida)
W71-04098

INSURING MAXIMUM BENEFICIAL USE OF WATER THROUGH LEGISLATION,
Kansas Univ., Lawrence.
H. E. Thomas.
In: Transactions of the Sixth Annual Conference on Sanitary Engineering, p 13-22, University of Kansas, Lawrence, Kansas, 1956. 10 p, 1 map.

Descriptors: *Legislation, *Beneficial use, *State governments, *Water resources development, Consumptive use, Domestic water, Non-consumptive use, Preferences (Water rights), Prior appropriation, Administrative agencies, Legal aspects, Priorities, Reasonable use, Remedies, Surplus water, Unappropriated water, Water sources, Water utilization, Proration, Riparian rights, Relative rights, Riparian waters, Severance, Prescriptive rights, Natural use.

The overall hydrologic pattern of the United States is categorized by this article into geographic areas with: (1) water deficiency; (2) water surplus; and (3) winter surplus and summer deficiency. Regulation and development of water use, encouragement of use modifications which will most benefit society, and protection of established rights and opportunities to develop water are cited as recommended objectives of legislation. The following problems for state legislation are examined: (1) limitation of rights, (2) protection of rights, (3) recording water rights, (4) authority and responsibility of the administrator, (5) policy guides for the administrator, (6) preferential use vis-a-vis priority of use, and (7) reservoir regulation. The author notes three doctrines for limiting water rights: (1) correlative, (2) mutual prescription, and (3) appropriation. Since preferential use and priority of use are both potentially controlling factors in determining water rights, it is observed that a state, in order to prevent confusion, should determine which doctrine prevails. The author concludes that legislation developing beneficial use should: (1) clearly define water rights, (2) provide broad authority and policies for the administrator, (3) utilize scientific study as a basis, and (4) encourage local responsibility for developing water resources. (Hart-Florida)
W71-04099

CONTINENTAL SHELF LAW: OUTDISTANCED BY SCIENCE AND TECHNOLOGY,
Jean T. Drew.
Louisiana Law Review, Vol 31, No 1, p 108-120, 1970. 13 p, 71 ref.

Descriptors: *Continental shelf, *International law, *Natural resources, *Technology, Law of the sea, International waters, Regimes, Oceans, Treaties, Continental margin, Continental slope, Coasts, Beds, Beds under water, Ownership of beds, Boundaries (Property), Conservation, Resource development, Governments, Regulation, Legislation, Legal aspects, Jurisdiction, Non-structural alternatives.

Examining the need for changes in the national and international law governing the continental shelf, this article points out the variance between the geological and legal definitions of the shelf. Newly developed and emerging uses of the shelf are discussed, and the development of present law is traced through the Truman Proclamation, the United Nations Convention on the Continental Shelf, and the Outer Continenetal Shelf Lands Act. Implications of United States v Ray, 423 F.2d 16 (5th Circ. 1970), are examined, including the uncertainty created, in coastal state's rights in the shelf, by new uses. The major defect of the present law is that it is limited to defining the coastal states' rights in the shelf's natural resources while new technology has made possible new uses of the shelf for transportation, defense, recreation, research, and even residential housing. The author concludes that this new technology demands that laws be revised or devised to insure coastal state adequate authority to pursue and govern all reasonable uses of the continental shelf. (Liptak-Florida)
W71-04100

WATER QUALITY CONTROL: A MODERN APPROACH TO STATE REGULATION,
Frank E. Maloney, and Richard Ausness.
Albany Law Review, Vol 35, No 1, p 28-59, 1970. 32 p, 131 ref.

Descriptors: *Water resources development, *Administration, *Water quality control, *Legislation, Water utilization, Administrative agencies, Planning, Abatement, Water pollution control, Water quality, Institutions, Water conservation, Water resources, Water Resources Research Act, Regulation, Permits, Non-structural alternatives, Standards, Legal aspects, Jurisdiction, Remedies, Administrative agencies, Supervisory control (Power).
Identifiers: *Model Water Codes.

Presenting chapter 5 of a six-chapter Model Water Code drafted at the University of Florida, this law review article sets forth a suggested state program for water quality control. The text of chapter 5 of the Code is provided, followed by a commentary on the origin and purpose of each section. After defining the usage of terms such as water quality, impairment of water quality, pollution, and wastes, the Code authorizes a State Water Resources Board to adopt and administer a water quality program. The program consists of classifying the state's waters, setting water quality standards, adopting a comprehensive plan, and providing for review and revision of the plan and thestandards. Local governing boards will issue permits for construction or operation of facilities affecting water quality, carry out inspections, and order abatement of violations of the standards. The Code also provides for jurisdiction for the local boards to seek injunctive relief against violators. The authors point out that the failure of prior efforts at state-wide water-quality programs stems from the tendency to provide legal authority without the financial support necessary for enforcement. (Liptak-Florida)
W71-04101

FEDERAL ENFORCEMENT UNDER THE REFUSE ACT OF 1899,
James T. B. Tripp, and Richard M. Hall.
Albany Law Review, Vol 35, No 1, p 60-80, 1970. 21 p, 78 ref.

Descriptors: *Rivers and Harbors Act, *Water pollution control, *Navigable waters, *Remedies, Wastes, Legislation, Judicial decisions, Rivers, Industrial wastes, Domestic wastes, Municipal

wastes, Oil wastes, Sewage, Waste water (Pollution), Pollutants, Water pollution, Water pollution sources, Pollution abatement, Water quality control, Waste disposal, Waste water disposal, Legal aspects, Regulation, Permits.
Identifiers: *Refuse Act.

Noting that old, under-utilized statutes may be applied to present problems, this article discusses the proscriptions and remedies provided by the Refuse Act of 1899, originally known as the Rivers and Harbors Appropriation Act of 1899. That act prohibits the discharge of any refuse into any navigable waters and provides for civil and criminal remedies. The authors discuss the Act in context with other sections of the Rivers and Harbors Act which also promote the protection of the nation's navigable waters. The article analyzes the judicial interpretations of the following terms and phrases: (1) 'refuse' (2) 'other than that flowing from streets and sewers and passing therefrom in a liquid state,' (3) 'suffer to be deposited,' (4) 'deposit,' (5) 'the bank of any navigable water,' and (6) 'impeding navigation.' Also examined is the requirement of scienter under the Act. The article also outlines the available criminal and civil remedies and discusses the procedures for obtaining injunctive relief against a polluter. The authors conclude that many questions of interpretation, notably whether a private right of action exists, await further cases to be resolved. (Liptak-Florida)
W71-04102

BUREAU OF RECLAMATION APPROPRIATION ACTS AND ALLOTMENTS: 1966 STATISTICAL SUPPLEMENT.
Bureau of Reclamation, Denver, Colo.
For primary bibliographic entry see Field 09D.
W71-04103

WATERSHED PROJECTS.

Hearings--Subcomm On Conservation and Credit, Comm On Agriculture--US House of Representatives, 90th Congress, 2nd Session, Jan 22, 23, July 9, 10, 11, 15, Oct 9, 1968. 202 p.

Descriptors: *Watershed management, *Water resources development, *Cost-benefit analysis, *Legislation, Project planning, Project benefits, Multiple-purpose projects, Water policy, Agricultural watersheds, Water conservation, Soil conservation, Flood protection, Administrative agencies, Federal government, Flood control, Recreation facilities, Drainage, Surface waters, Runoff, Costs, Rainfall, Water storage, Land management, Reservoirs, Reservoir operation.

Hearings were held before the House Subcommittee on Conservation and Credit of the Committee on Agriculture to discuss various proposed watershed projects throughout the United States. The Subcommittee discussed proposed projects located in: South Carolina, Wisconsin, California, Alabama, Florida, Louisiana, Colorado, Arkansas, Kansas, Texas, Indiana, West Virginia, Oklahoma, Idaho, North Carolina, South Dakota, North Dakota, Virginia, Georgia, Iowa, and Kentucky. Of prime interest to the Subcommittee were the cost-benefit ratios of projects, the size of the area benefited, and the number of beneficiaries. Most projected benefits were agricultural. However, urban, transportation, and recreational benefits were frequent. Discussion also centered on the proposed watershed structures, the areas' past experience with flooding, and their history of flood damage. Funding of the project was to come from both federal and local funds. The relative value of each project was important since not all of the proposed projects could be funded from available appropriations. (Duss-Florida)
W71-04104

FEDERAL WATER RESOURCES RESEARCH ACTIVITIES.
Federal Council for Science and Technology, Washington, D.C.

Report to the President on Water Resources Research, Senate Comm on Interior and Insular Affairs, 88th Cong, 1st Sess, March 1963. 213 p, 50 tab, 45 ref.

Descriptors: *Scientific personnel, *Federal government, *Water resources development, *Research and development, Water policy, Water resources, Water supply, Water quality, Hydrologic cycle, Groundwater, Streams, Weather, Water pollution, Environment, Administration, Administrative agencies, Costs, Streamflow, Manpower, Education, Training, Universities, Grants, Projects, Water demand, Water reuse.

The Federal Council for Science and Technology prepared this report on water resources research to provide: (1) policy guidance for federal agencies participating in research and (2) a basis for a coordinated scientific research program on water. An initial summary outlines the Report's findings and conclusions. Chapter I discusses the need for water research, centering on increased water demand in the future and the value of planning for more efficient use of water resources. Chapters 2 and 3 discuss the federal government's responsibilities for water resources research and the responsibilities of specific agencies. Chapter 4 discusses technical problems and research programs. Topics include: (1) the nature of water, (2) the water cycle, (3) water in relation to land management, (4) water resources development and control, (5) water quality, (6) water reuse, (7) economic and institutional aspects of water resources, (8) engineering systems for water resources development, and (9) manpower and research facilities. Estimated costs of various programs are provided. Chapter 5 gives a program summary and evaluation. Chapter 6 discusses the manpower necessary to carry on adequate research, and chapter 7 discusses coordination of the research activities of various federal agencies. Chapter 8 outlines legislative aspects which center on assuring a continued flow of competent manpower for research activities. (Duss-Florida)
W71-04105

ENVIRONMENTAL JURISDICTION IN THE CONGRESS AND THE EXECUTIVE,
Edmund S. Muskie.
Maine Law Review, Vol 22, No 1, p 171-187, 1970. 16 p, 54 ref.

Descriptors: *Federal jurisdiction, *Institutional constraints, *Legislation, *Political aspects, Coordination, Legal aspects, Administrative agencies, Administrative decisions, Non-structural alternatives, Water Quality Act, Water pollution control, Water resources development, Thermal pollution, Impaired water quality, Dredging, Landfills, Pollutants, Jurisdiction, Federal government, Nuclear powerplants, Hydroelectric plants.
Identifiers: Water Restoration Act.

This article examines the scope of, conflicts within, and proposed improvements in federal environmental jurisdiction. The centers of congressional jurisdiction over such areas as thermal pollution, hydroelectric plant location and effects, water pollution, dredging, the filling of wetlands, continental shelf oil leasing, and landfill in harbors and estuaries are described. The article sets forth congressional committees responsible for legislation such as the Water Quality Act of 1965 and the Clean Waters Restoration Act of 1966, and the extent of their authority. Jurisdictional conflicts with other committees and proposals for more coordinated and effective legislative action are discussed. A description is given of the fragmented executive-branch jurisdictional divisions dealing with environmental programs. The article presents proposals for solving conflicts and streamlining the executive environmental programs, policies, and personnel distributions. (Earl-Florida)
W71-04106

IN RE ROMA (ABILITY OF UPLAND OWNER TO ACQUIRE TITLE TO SUBMERGED LANDS BY ADVERSE POSSESSION).

227 NYS 46 (Sup Ct App Div 1928).

Descriptors: *New York, *Navigable rivers, *Ownership of beds, *Prescriptive rights, Beds under water, Land tenure, Real property, Rivers, Riverbeds, Beds, State governments, Landfills, Legal aspects, Judicial decisions, Land.
Identifiers: *Adverse possession.

On plaintiff's attempt to register title to submerged land, the New York Supreme Court held per curiam that an upland owner, as against the state, cannot by filling in or by adverse possession acquire title to submerged land under a tidal, navigable river. (Hart-Florida)
W71-04146

CHICK SPRINGS WATER CO V STATE HIGHWAY DEP'T (STATE'S LIABILITY FOR INVERSE CONDEMNATION WHEN INADEQUATE CULVERT CAUSES FLOODING).

157 SE 842-851 (SC 1931).

Descriptors: *South Carolina, *Condemnation, *Culverts, *Floods, Eminent domain, State governments, Administrative agencies, Highways, Roads, Streams, Springs, Recreation, Legislation, Damages, Landfills, Adjudication procedure, Judicial decisions, Legal aspects, Remedies, Governments.
Identifiers: *Constitutions, Sovereign immunity.

Plaintiff landowner sued defendant state highway department for inverse condemnation. Plaintiff's land contained a mineral spring and an amusement park. When defendant constructed a road, it threw up an embankment on plaintiff's land and placed a culvert through it to drain the creek traversing plaintiff's tract. The culvert was too small, and the creek backed up onto plaintiff's land. Plaintiff brought the action under a constitutional provision requiring compensation for taking of private property. Defendant contended that plaintiff had not filed his claim within the period required by a statute consenting to suit against defendant; therefore, sovereign immunity had not been waived. However, the Supreme Court of South Carolina held that the statute was inapplicable to proceedings of this type. The constitutional provision was self-executing and itself waived sovereign immunity. Holding that plaintiff's injury was a 'taking' within the constitutional prohibition, the court remanded the action for trial. (Hart-Florida)
W71-04197

COAL CREEK DRAINAGE AND LEVEE DIST V SANITARY DIST OF CHICAGO (DRAINAGE DISTRICT'S LIABILITY FOR DISCHARGE OF EXCESSIVE WATER INTO RIVER).

336 Ill 11, 167, NE 807-823 (1929).

Descriptors: *Illinois, *Waste dilution, *Discharge (Water), *Drainage districts, Drainage, Sewage, Hydroelectric plants, Drainage effects, Drainage engineering, Drainage practices, Drainage programs, Drainage systems, Electric power production, Electric power, Non-consumptive use, Navigable rivers, Cities, Sewage, Waste disposal, Sewage disposal, Judicial decisions, Legal aspects, Adjudication procedure, Floods.

Plaintiff drainage district sued defendant drainage district for injury caused by discharge of excess water into a navigable river. Defendant had discharged water to dilute sewage and to generate electrical power. The water ultimately flowed into a river which passed through plaintiff district. By statute, defendant was required to use a prescribed volume of water for each 100,000 inhabitants.

Plaintiff contended that, in order to generate electricity, defendant had negligently used more water than required to dilute sewage, causing the river to overflow and injure plaintiff. The Supreme Court of Illinois stated that: (1) plaintiff must prove defendant's population, the amount of sewage discharged, the amount of water required for dilution, and that excessive water caused the injury; (2) defendant was required by statute to discharge sufficient water to prevent the sewage canal from being obnoxious; and (3) defendant might utilize water to generate electricity, despite its organization for drainage purposes, when the proceeds were used to support the drainage effort. Determining that the trial court erred in admitting evidence, giving certain jury instructions, and refusing certain instructions, the court reversed the judgment and remanded the action for a new trial. (Hart-Florida)
W71-04198

LITTLE FALLS FIBRE CO V HENRY FORD AND SON, INC (FLASHBOARDS REDUCING RIPARIAN OWNER'S POWER HEAD).
249 NY 495, 164 NE 558-563 (1928).

Descriptors: *New York, *Administrative decisions, *Permits, *Dams, Administrative agencies, Federal governments, United States, Navigable rivers, Navigable waters, Navigation, Legislation, Legal aspects, Judicial decisions, Power head, Hydroelectric plants, Hydroelectric power, Hydroelectric project, Licensing, Structures.

Plaintiff manufacturing company brought action to enjoin defendant manufacturing company from maintaining flashboards on a federal dam. Plaintiff also sought damages resulting therefrom. Defendant had applied for, and received from the Federal Power Commission, a permit to erect the flashboards. The resulting increased water height decreased plaintiff's upstream power head. Plaintiff asserted entitlement to flow unobstructed by individuals, despite subjection to the congressional power to regulate navigation. Defendant contended that its permit subjected plaintiff to his right to maintain the flashboards. The Court of Appeals of New York stated that: (1) the flow of a navigable river is not property subject to the fifth amendment; (2) a riparian owner whose lands are unflooded has no standing for judicial review of congressional decisions to regulate navigable waters; (3) in absence of supporting evidence, Federal Power Commission licensing of projects are reviewable; and (4) the Commission's jurisdiction to issue licenses is reviewable. Determining that defendant's right to obstruct the river must be established independently of the license, the court held defendant liable for plaintiff's injury. (Hart-Florida)
W71-04203

LOWE V INDIANA HYDROELECTRIC POWER CO (AUTHORITY OF HYDROELECTRIC COMPANY TO CONDEMN LAND FOR FLOWAGE).
151 NE 220-226 (Ind 1926).

Descriptors: *Indiana, *Hydroelectric plants, *Condemnation, *Dams, Eminent domain, Backwater, Legislation, State governments, Riparian land, Riparian rights, Hydroelectric power, Non-navigable waters, Judicial decisions, Legal aspects, Electric power industry, Electric power-plants.

Plaintiff hydroelectric company sought to condemn riparian land owned by defendant. Plaintiff had to purchase the land, which the backwater from its dam would overflow, but was unsuccessful. Defendant contended that plaintiff could not condemn the lands. The Supreme Court of Indiana held that: (1) A riparian owner may utilize water lawfully, if the water flows thereafter in its normal state; (2) A legislation grant is not required to erect a dam not altering the stream's natural course; (3) Plaintiff was authorized by statute to condemn lands for an authorized purpose; (4) A declaration of public necessity was unnecessary; (5) Plaintiff's lease of electric power did not affect its ability to condemn lands; (6) Operation of the dam for electricity was a public use; and (7) Evidence of comparative benefits and damages from the dam was properly excluded by the trial court. Plaintiff had properly condemned defendant's land after reasonable efforts to purchase. (Hart-Florida)
W71-04217

PARKS V PENNSYLVANIA RR (TITLE TO LAND PREVIOUSLY FLOOD BY BACKWATER).
301 Pa 475, 152 A 682-685 (1930).

Descriptors: *Pennsylvania, *Condemnation, *Land tenure, *Ownership of beds, Flooding, Compensation, Dams, Real property, Eminent domain, Railroads, State governments, Legal aspects, Judicial decisions, Governments, Land, Backwater.
Identifiers: *Adverse possession.

Plaintiff possessor of riparian land sued to eject defendant railroad. The disputed land had been previously overflowed by backwater from a dam, and title to the flooded land was vested in the state by condemnation. The dam later broke, and the water receded. The dam was not restored. Plaintiff took possession, but the state conveyed the land to defendant. Plaintiff claimed title by abandonment, in that defendant had failed to use the land, and by adverse possession. Noting that whether compensation was paid for the condemned land was immaterial, the Supreme Court of Pennsylvania held that title had been in the state by condemnation. Plaintiff could eject defendant only on the strength of his own title, rather than the weakness of defendant's. The court held that the state's title was not divested by abandonment. Failure of a state's grantee to use granted land may result in divestment of the grantee's title, but does not revest title in its former owner. Determining that plaintiff had not established adverse possession for the statutory period, the court held that title was in defendant. (Hart-Florida)
W71-04243

BAY RIDGE DOCK CO V UNITED DRY DOCKS, INC (RIGHT TO FILL TO BULKHEAD LINE INCLUDES RIGHT TO MAINTAIN FLOATING DRY DOCK).

146 Misc 404, 262 NYS 212-216 (1932).

Descriptors: *New York, *Landfills, *Bulkhead line, *Piers, Navigable waters, Beds, Navigation, Docks, Remedies, Riparian land, Riparian rights, Riparian waters, Ownership of beds, Real property, Land tenure, Relative rights, Regulation, Governments, State governments, Legal aspects, Judicial decisions.

Plaintiff dock company brought action to restrain defendant dock company from mooring a floating drydock adjacent to defendant's pier and over defendant's submerged land. Plaintiff contended that the dry dock interfered with navigation and with access to plaintiff's pier. Defendant contended that the dry dock was inside the established bulkhead line and could be maintained under defendant's right to fill up to the bulkhead line. The court noted that the grant of lands under water and the establishment of a bulkhead line gave defendant a right to fill. Although there is a right of navigation over such submerged land until the right to fill is exercised, defendant had the right to maintain the dry dock as long as the required minimum clearance between piers was maintained. Plaintiff could not, at the expense of defendant's property rights, enlarge his right of access beyond the minimum clearance. (Liptak-Florida)
W71-04245

HANOVER DRAINAGE AND LEVEE DIST V SANTA FE DRAINAGE AND LEVEE DIST (DRAINAGE DISTRICT'S AUTHORITY TO REMOVE NATURAL BARRIER AND CHANGE DIRECTION OF DRAINAGE FLOW).
319 111 142, 149 NE 752-754 (1925).

Descriptors: *Illinois, *Ditches, *Drainage districts, *Natural flow, Drains, Drainage systems, Natural flow doctrine, Drainage water, Drainage, Surface waters, Surface runoff, Levees, Drainage effects, Legislation, Water rights, Alteration of flow, Obstruction to flow, Watersheds (Divides), Watershed management, Legal aspects, Judicial decisions.

Plaintiff drainage and levee district petitioned for permission to construct a drainage ditch and connect it with defendant district's ditch. Landowners in plaintiff district had petitioned for and obtained an order requiring plaintiff to improve its drainage. Defendant objected and contended that the connection would require the removal of a natural barrier to the flow of water. This would change the natural flow of water from east to west. Reversing a judgment for plaintiff, the Supreme Court of Illinois held that, where the connection would result in reversing the direction of the natural flow of water and the removal of natural barriers to flow, plaintiff had no right or authority to connect its ditches to that of defendant. (Liptak-Florida)
W71-04246

PENNSYLVANIA RR V LINCOLN TRUST CO (RAILROAD AND MUNICIPAL NEGLIGENCE IN MAINTAINING WATER PURITY).
167 NE 721-730 (Ind App 1929).

Descriptors: *Indiana, *Cities, *Railroads, *Water supply, Water pollution sources, Water pollution, Water pollution effects, Public health, Mortality, Pollutants, Epidemics, Diseases, Pipelines, Water delivery, Adjudication procedure, Judicial decisions, Legal aspects, Damages, Remedies.
Identifiers: *Contaminated water supply.

Plaintiff administrator of decedent's estate sued defendant railway company and defendant municipality for wrongful death. The city had authorized the railroad to tap into its water system. The railroad's system was defective and permitted contaminated water to flow into the municipal system, causing decedent's demise from typhoid. Plaintiff asserted that the city was negligent in failing to inspect the railroad's connection and that the railroad had negligently maintained its system. The Appellate Court of Indiana stated that the city was not a guarantor of its water, but was bound to use reasonable care to insure an uncontaminated supply. Plaintiff was not required to prove with absolute certainty that drinking water caused decedent's death, nor was plaintiff required to prove that the city actually knew the water was contaminated. Determining that the evidence supported the trial court's holding that defendants' negligence was the proximate cause of decedent's death, the court held both liable. (Hart-Florida)
W71-04252

PUBLIC WORKS AUTHORIZATIONS, 1968 - RIVERS AND HARBORS - FLOOD CONTROL AND MULTIPLE PURPOSE PROJECTS - PART I.
Committee on Public Works (U. S. Senate). Subcommittee on Flood Control - Rivers and Harbors.

Hearings Before the Subcommittee on Flood Control - Rivers and Harbors, of the Public Works Committee, United States Senate, 90th Congress 2nd Session, Jan 30, 31 and Feb 1 and 7, 1968. 96 p, 10 illus.

Descriptors: *Political aspects, Federal government, Federal Project Policy, *Permits, *Water permits, Administrative agencies, Public rights, Recreational facilities, Reservoir operation, *Legislation.
Identifiers: Floating facilities, Federal reservoirs.

The subcommittee met to consider S2236, a bill which would prohibit the Secretary of the Army from collecting any fee for the issuance of any permit or license for any private floating facility on any of the waters of any project administered by the Secretary acting through the Chief of Engineers. The bill would not prohibit the Secretary from requiring a permit or license for any such floating facility. The Corps of Engineers issues permits allowing members of the public to construct floating facilities for private use on Federal Reservoir Projects. The Corps also allows commercial floating facilities to be constructed on these reservoirs in return for a rental fee. On November 17, 1966 the Corps issued a circular stating that permits would henceforth be issued upon a charge to all owners of floating facilities used for private purposes. Voluminous testimony presented to the subcommittee reflected the general feeling that the change would be contra to the nation's long established toll-free waterways policy and would tend to defeat the purposes of federal legislation to expand outdoor recreational facilities, notwithstanding that the fee purports to charge for the use of federal land beneath the facility and not for the use of the water itself. No decision is reported. (Molica-Florida)
W71-04254

HEARINGS BEFORE THE SUBCOMMITTEE ON FLOOD CONTROL - RIVERS AND HARBORS; THE COMMITTEE ON PUBLIC WORKS, UNITED STATES SENATE, 90th CONGRESS, 2nd SESSION.
Committee on Public Works (U. S. Senate). Subcommittee on Flood Control - Rivers and Harbors.

Hearings - Sub Comm on Flood Control - Rivers and Harbors - Comm on Pub Wks, US Senate, Jan 30, 31, Feb 1 and 7, 1968. 194 p.

Descriptors: *Federal government, *Legislation, *Federal project policy, *Projects, Project purposes, Project benefits, Costs, Cost allocation, Cost-benefit ratio, Local governments, Economics, Navigable waters, Administration, Adoption of practices, Flood control, Flood protection, Aquatic weed control, Beach erosion, Harbors, Construction, Multiple purpose projects, Breakwaters, Legal aspects, Social aspects, Regions.

During these hearings before the Subcommittee on Flood Control - Rivers and Harbors, several bills were discussed, witnesses heard and documents presented. Items considered were a proposed dock charge by the Corps of Engineers, and flood control projects for: Carlsbad, N. M.; Aquilla Creek and Texas City, Texas; Little Dell Reservoir, Utah; and the Norwalk River Basin in Connecticut. Also considered were harbor construction and improvement projects for: Fall River, Mass.; Bristol, Rhode Island; and Forestville Harbor and Tawas Bay, Michigan. The Fort Pierce, Florida, Beach Erosion Control Project and the Water Hyacinth Control Program in Florida were discussed. On each project, evidence was taken as to project purposes, effects and benefits of the project, costs, cost-benefit ratio, and local responsibilities for paying the non-federal share of the project. The U. S. Army Corps of Engineers was responsible for all projects. (Caldwell-Florida)
W71-04255

PROCEEDINGS: CONFERENCE ON POLLUTION OF LAKE MICHIGAN AND ITS TRIBUTARY BASIN, ILLINOIS, INDIANA, MICHIGAN, AND WISCONSIN.
For primary bibliographic entry see Field 05G.
W71-04256

LAW OF SEASHORE, WATERS AND WATERCOURSES OF MAINE AND MASSACHUSETTS,
For primary bibliographic entry see Field 04A.
W71-04257

PLAN FOR DEVELOPMENT OF THE LAND AND WATER RESOURCES OF THE SOUTHEAST UNITED STATES RIVER BASINS.
United States Study Commission, Southeast River Basins, Plan for Development of the Land and Water Resources of the Southeast River Basins (1963). 135 p.

Descriptors: *River basin development, *Southeast U. S., *Resource development, *Planning, Project planning, Terrain analysis, River basins, Regions, Benefits, Costs, Cost sharing, Future planning (Projected), Flood control, Recreation, Navigation, Soil conservation, Hydroelectric power, Reservoirs, Water supply, Multiple-purpose projects, Economics, Industrial production, Land use, Water utilization.

The United States Study Commission has developed a comprehensive plan for the development of the resources of the river basins of the Southeastern United States. The report is a detailed explanation of the plan. Part One includes a description of the Southeast River Basins Area, a discussion of its resources, and a presentation of the present and future population and economy. Part Two presents the needs of the Area for each aspect of the plan. Part Three describes planning procedures as applied to the study. Part Four presents the comprehensive plan broken down by individual river basins. Part Five contains the Commission's conclusions and recommendations. The plan was designed to meet the needs of the Area through the year 2000. Aspects of the plan for each basin include flood control, water supply, navigation, hydroelectric power, drainage and irrigation, soil conservation, forest conservation, pollution abatement, recreation, and other beneficial purposes. (Caldwell-Florida)
W71-04266

COMPETITION FOR WATER IN AN EXPANDING ECONOMY: POLICIES AND INSTITUTIONS,
Arizona Univ., Tucson. Dept. of Agricultural Economics.
Maurice M. Kelso.
Nov 1, 1967. 20 p, 2 ref. OWRR Project B-003-ARIZ (5).

Descriptors: *Water rights, *Riparian rights, *Appropriation, Surface waters, Groundwater.

The need for major changes in the institutional and legal allocation of water are discussed. Riparian rights and appropriative rights, as they have evolved through custom and judicial decisions, have become inflexible institutions. The present system of water tenure does not provide for the most socially beneficial development and delivery of growing water needs. It is suggested that the bargaining transaction and the market are the best adapted devices for readjusting water institutions. (Holmes-Rutgers)
W71-04268

HUNTER V VAN KEUREN (BOUNDARY DISPUTE AT LAKESHORE).
130 Misc 599, 224 NYS 153-161 (Sup Ct 1927).

Descriptors: *New York, *Land tenure, *Boundary disputes, *Shores, Boundaries (Property), Lake shores, Littoral, High water mark, Low water mark, Real property, Navigable waters, Non-navigable waters, Legal aspects, Judicial decisions, Land, Lakes.

In an action of ejectment, the Supreme Court of New York stated that: (1) in a conveyance of lands bounded by navigable waters, title extends to the high water mark; and (2) 'shore' or 'shore line' in a title description means the land between the high and low water marks. (Hart-Florida)
W71-04276

DUCK ISLAND HUNTING AND FISHING CLUB V EDWARD GILLEN DOCK, DREDGE AND CONSTRUCTION CO (DISSOLUTION OF DRAINAGE DISTRICT).
330 Ill 121, 161 NE 300-305 (1928).

Descriptors: *Illinois, *Drainage programs, *Contracts, *Navigable waters, Legislation, Administrative agencies, Administrative decisions, State governments, Federal government, Permits, Debt, Cost repayment, Drainage, Rivers, Streams, Navigable rivers, Judicial decisions, Legal aspects.

Plaintiff club petitioned to have a drainage district dissolved. Defendant dredging company, having a contract with the district, contested the action. The first drainage plan was ordered by the county court, assessments were levied, and the contract with defendant was let, all without approval by the state public works department and the War Department. These plans were modified, and an additional assessment was levied, whereupon district landowners petitioned for dissolution. The petition was approved under a statute permitting dissolution when no indebtedness existed and the costs of dissolution had been advanced. Defendant contended that the existence of its contract evidenced an outstanding indebtedness prohibiting dissolution. Plaintiff asserted that since the contract was let prior to approval by the public works and War departments, it was illegal and void under statutes prohibiting obstruction of navigable waters without approval. Sustaining plaintiff's assertion by noting that navigable waters were involved, the Supreme Court of Illinois held the dissolution valid, notwithstanding a subcontractor's expenditures in reliance on the contract. (Hart-Florida)
W71-04277

CITY OF SALEM V HARDING (CITY'S NEGLIGENCE IN CAUSING ILLNESS BY CONTAMINATION OF WATER SUPPLY).
121 Ohio St 412, 169 NE 457-460 (1929).

Descriptors: *Ohio, *Water supply, *Public health, *Water pollution, Water pollution sources, Water pollution effects, Diseases, Epidemiology, Pollutants, Epidemics, Pipelines, Sanitary engineering, Sewage effluents, Sewage bacteria, Sewage disposal, Sewage, Cities, Municipal wastes, Sewers, Streams, Legal aspects, Judicial decisions, Adjudication procedure.

Plaintiff citizen sued defendant city for his daughter's illness, which he alleged was caused by contamination of the water supply. The line supplying water for plaintiff was laid next to a private sewer line which was contaminating a stream. When efforts to persuade residents to disconnect from this private sewer failed, defendant's health officer plugged the sewer. This caused the sewage to back up into plaintiff's water supply, and plaintiff's daughter became ill. Defendant contended that it was not responsible for the acts of its health officer acting under the instructions of the board of health. Noting that the sewer was a nuisance, the Supreme Court of Ohio held that defendant was liable for the acts of its officers, who must use ordinary care to prevent contamination of the water supply. However, the court observed that a municipality is not a guarantor of the purity of the water supply, but is only held to the exercise of ordinary care. Judgment for plaintiff was affirmed. (Hart-Florida)
W71-04278

MANNING V METROPOLITAN DISTRICT COMM'N (CONSTITUTIONALITY OF ACT AUTHORIZING CONDEMNATION FOR DRAINAGE).
270 Mass 348, 169 NE 910-911 (1930).

Descriptors: *Massachusetts, *Easements, *Legislation, *Condemnation, Drainage, Eminent domain, Farms, Ditches, State governments, Natural flow doctrine, Judicial decisions, Legal aspects, Surface drainage, Governments, Administrative agencies.

Identifiers: *Constitutionality.

Plaintiff farm owner petitioned for a writ of certiorari to quash eminent domain proceedings brought by defendant commission to establish a drainage easement across plaintiff's land. Water drained from a cemetery adjacent to plaintiff's land, and plaintiff had obtained an injunction restraining the cemetery company from diverting water onto plaintiff's land. The easement sought by defendant restored this drainage across plaintiff's land. Plaintiff asserted: (1) that the cemetery instituted and secured the drainage legislation to avoid the court decree, (2) that the act was a mere contrivance for the cemetery's benefit, and (3) that therefore the act was unconstitutional as a taking for private use. Plaintiff furthermore contended that the legislation was unconstitutional since existing natural drainage would be adequate with improvements. Stating that the statute was presumed valid, and that plaintiff had not shown that the cemetery had obtained it for its own benefit, the Supreme Judicial Court of Massachusetts rejected plaintiff's first assertion. Furthermore, the court held that the validity of the act authorizing the condemnation was unaffected by the existence of a natural drainage system. (Hart-Florida)
W71-04279

STRUCTURE OF PUBLICLY-OWNED WATER UTILITIES,
Florida Univ., Gainesville. Dept. of Economics.
C. W. Fristoe, F. O. Goddard, and N. G. Deig.
Journal of American Water Work Association, Vol 62, No 4, April 1970, p 215-219. 2 tab, 3 ref.

Descriptors: *Public utilities, Local governments, State jurisdiction, Water rates, Indiana, Maine, Montana, West Virginia, Wisconsin, *Utilities.
Identifiers: *City councils.

A study was made of control over publicly-owned water systems in the United States, dealing particularly with the relationships that exist between the water utilities and municipal governments. The results of questionnaires sent to the chief water utility executives of water systems in 340 cities with populations of 10,000 or more revealed the difficulties that municipal water systems face when attempting to operate as business enterprises. Comparisons were made of the ways prices are determined, quality controlled and quantity determined under various means of control of publicly-owned water systems. (Holmes-Rutgers)
W71-04281

THE INSTITUTIONAL FRAMEWORK FOR WATER MANAGEMENT IN ENGLAND AND WALES,
Bruce Mitchell.
Natural Resources Journal, Vol 10, No 3, July 1970, p 566-589. 20 ref, 2 fig.

Descriptors: *Water resources development, Planning, Multiple-purpose projects, Water law, *Institutions.
Identifiers: *England, Wales, White Paper, Water Resources Board.

The author describes the considerable progress that has been made since 1940 in improving water management practices at the micro-level in England and Wales, but concludes that greater attention must be given to the macro-level of planning to link together proposals for different variables, localities and regions. The article details the progress that has been made in the introduction, application and acceptance of river basin planning, multiple-purpose resource use and the regrouping and reorganization of water undertakings. (Holmes-Rutgers)
W71-04282

WATER AND CULTURE: NEW DECISION RULES FOR OLD INSTITUTIONS,
Arizona Univ., Tucson. Bureau of Ethnic Research.
Harland Padfield, and Courtland L. Smith.
Rocky Mountain Social Science Journal, Vol 5, No 1, p 23-32, April 1968.

Descriptors: *Arid lands, *Water allocation (Policy), *Water districts, *Institutions, *Water utilization, Water conservation, Water distribution (Applied), Water law, Water resources, Water transfer, Water users, Water works, Arizona, Semiarid climates, History, Social aspects, Developed waters, Irrigation practices, Irrigation effects, Agriculture, Crop production, Labor supply, Economics of scale, Economic feasibility, Dry farming, Hydroelectric power, Droughts, Legal aspects, Water contracts, Great Plains, Groundwater.
Identifiers: *Salt River Project (Arizona), *Waterspace, *Agricultural mechanization.

As American agriculture moved westward from the humid east to the prairies to the semiarid Great Plains, changes in water availability resulted in changes in agricultural operations. The small, family-size subsistence unit developed into the large-scale, mechanized dry farms of the plains. When the plains formula was moved to the arid West, irrigation created a bastardized agriculture in which large-scale crop operations developed through mechanization of planting and growing phases, but which depended upon large, depressed migratory labor populations for harvesting. In arid lands, areas of high water availability impose sharp spatial limitations on agriculture and settlements, and such oases are termed 'waterspace'. This waterspace led to a new agrarian institution--the water users' association. The history is traced of 1 such association in the Salt River Valley, Arizona. Originally this and other associations were committed to the problems of water distribution for agricultural purposes, but recent urban and industrial competition for waterspace have shifted their foci to urban water needs and hydroelectric power. In Arizona this competition, together with declining groundwater levels, seem to indicate a contracting agricultural sector. (Casey-Arizona)
W71-04296

OFFSHORE OIL SPILLS: AN EVALUATION OF RECENT UNITED STATES RESPONSES,
Ved P. Nanda, and Kenneth R. Stiles.
San Diego Law Review, Vol 7, No 3, p 519-540, July 1970. 22 p, 162 ref.

Descriptors: *Legislation, *Water pollution, *Oil, *Oil industry, United States, Exploitation, Oil fields, Oil reservoirs, Natural gas, International waters, Exploration, Geologic formations, Water pollution effects, Water pollution sources, Pollutants, Oil wells, Drill holes, State governments, Federal Government, California, Submerged Lands Act, Legal aspects, Water pollution control, Pollution abatement, Non-structural alternatives.
Identifiers: *Oil spills.

Three recent oil spills--the Torrey Canyon disaster, the Santa Barbara channel faulted strata leakage, and the Gulf of Mexico blowouts--have initiated action by the United States to prevent similar future occurrences. Evaluation of these responses is the objective of this article. Policy considerations conflicting with the prevention of oil spills, such as increasing oil and gas consumption in the United States, are discussed. It is observed that exploitation of offshore petroleum reserves is a relatively recent venture. The development of governmental regulations concerning offshore drilling through the Submerged Lands Act and the Outer Continental Shelf Lands Act is examined. The causes, results, and responses to the Santa Barbara spill are analyzed in detail. The authors emphasize that compliance with the California regulations for offshore wells would have prevented the Santa Barbara spill. The Gulf of Mexico blowouts are examined similarly. The authors conclude that legislation pertaining to oil spills should provide: (1) strict liability for clean-up and damages from spills, (2) broad discretion in the regulating agency to prescribe rules for offshore petroleum exploitation, and (3) for compulsory adjudication to determine fault in pollution incidents. (Hart-Florida)
W71-04305

RECLAMATION IN THE UNITED STATES,
California State. Dept. of Water Resources, Sacramento.
For primary bibliographic entry see Field 06C.
W71-04306

FEDERAL WATER-POWER LEGISLATION,
Columbia Univ., New York. Studies in the Social Sciences.
Jerome G. Kerwin.
Federal Water-Power Legislation, New York, AMS Press, Inc., 1968. 396 p, 10 tab, 362 ref, 8 append.

Descriptors: *Federal Power Act, *Water allocation (Policy), *Federal government, *Legislation, Water resources development, Federal-state water rights conflicts, Federal jurisdiction, State jurisdiction, Legal aspects, Judicial decisions, Public utilities, Economic impact, Political aspects, Political constraints, Water utilization, Hydro-electric plants, Riparian rights, Administration, Navigable rivers, Water resources, Prior appropriation, Power marketing, Economic efficiency, Electric power industry.
Identifiers: *Constitutionality.

Detailed in this study are the legal, economic, and historical aspects of the battle for federal water-power legislation, culminating in the Federal Water Power Act of 1920. The comparative economic advantages of water power, its historic uses, and its potential for future development are discussed in Chapter I. The legal and constitutional aspects of federal water power are presented in Chapter II. Rights in running water under both riparian rights and prior appropriation doctrines are discussed. Constitutional issues examined by the author include: (1) the extent of state water power, (2) the federal government's right to lease water rights in the public domain, (3) the treaty-making power as a source of federal water power, (4) federal power over navigable streams, and (5) the extent of federal administrative power and discretion. In Chapters III and IV congressional battles over water-power legislation before 1920 are examined. The enactment of the Federal Water-Power Act of 1920, with full text provided in an appendix, is discussed in Chapter V. Progress under the Act, its weaknesses, legal challenges to the Act, and the extent of activity undertaken pursuant to the Act are considered in Chapter VII. (Earl-Florida)
W71-04307

PUBLIC WATER POLICY IN TENNESSEE.
Public Administration Service, Chicago, Ill.

June 1956. 175 p, 19 fig, 22 tab, 72 ref, 1 append.

Descriptors: *Tennessee, *Water policy, *Water law, *Water utilization, Administration, Riparian rights, Reasonable use, Water supply, Surface waters, Groundwater, Public rights, Water resources development, Water pollution, Domestic water, Municipal water, Industrial water, Competing uses, Prior appropriation, Water conservation, Irrigation, Judicial decisions, Legal aspects, Water quality, Administrative agencies, Legislation.

Fulfilling the objectives of a bill passed by the Tennessee legislature, the State Water Policy Commission had this study prepared on Tennessee's water resources and water laws. Chapter I is an introduction and summary and outlines existing water laws in Tennessee, available water supplies, various water uses, and a proposed state water policy. Chapter II discusses Tennessee water law under two headings: (1) the common law riparian doctrine relating to individual rights and obligations with respect to water utilization; and (2) statutory law in such areas as water pollution, public health, flood control and drainage, navigation, water supply, recreation, and interstate relations. Chapters III through V gives factual information on the availability of water resources, various types of withdrawal uses of water, and uses requiring modification and control of stream flow. Some policy recommendations are made in these chapters. Chapter VI is devoted entirely to water policy. It

recommends: (1) statutory modification of the common law, including declaration of public ownership of the water supply, elimination of conflicts in the law, and a move to some type of appropriation system; (2) establishment of a state division of water resources to administer water resources; and (3) creation of agencies for local water users. (Duss-Florida)
W71-04308

BUREAU OF RECLAMATION APPROPRIATION ACTS AND ALLOTMENTS.
Bureau of Reclamation, Washington, D.C.
For primary bibliographic entry see Field 09D.
W71-04309

TOWN OF PERU V STATE (COMPENSATION FOR STATE'S APPROPRIATION OF TOWN'S DOCK).

315 NYS2d 775-777 (Sup Ct App Div 1970).

Descriptors: *New York, *Eminent domain, *Compensation, *Docks, Piers, Lakes, Navigable waters, Navigation, Boats, Cities, Access routes, Condemnation, Land, Legal aspects, Judicial decisions, Roads, Recreation, Local governments.

Plaintiff town sought compensation for appropriation by defendant state of a dock on Lake Champlain and of land providing an access route to the dock. The town had maintained the dock from the time of purchase, constructed a boat launching ramp, and held the dock for the use of town residents. Plaintiff contended it held the dock in a proprietary capacity, while defendant contended that plaintiff held the dock in a governmental capacity, for the furtherance of navigation, and therefore was not entitled to compensation for its appropiation by defendant. The Supreme Court of New York reversed a lower court's action by defendant. The Supreme Court of New York reversed a lower court's dismissal of plaintiff's claim. The town maintained the dock for use of residents only and therefore held the property in a proprietary capacity. The dock was used by pleasure craft and not cargo vessels. Private piers erected on navigable waters cannot be appropriated for a purpose not in the interests of navigation without payment of compensation. (Duss-Florida)
W71-04310

PEOPLE V PORT OF NEW YORK AUTHORITY (REMEDY FOR POLLUTION OF STATE PROPERTY).
315 NYS2d 9-12 (Sup Ct 1970).

Descriptors: *New York, *Water pollution, *Public rights, *Water pollution control, Legislation, Bays, Water pollution sources, Airports, Prescriptive rights, Remedies, Environment, Legal aspects, Judicial decisions, Navigable waters, Public health.

Plaintiff state of New York sought to temporarily enjoin defendant Port of New York Authority from polluting a bay through the discharge of fuel or oil from John F. Kennedy International Airport, which was operated by the defendant. Defendant contended that: (1) it should not be singled out for prosecution as it was one of many contributors to the pollution, (2) the pollution had continued for many years, and (3) issuance of an injunction would require closing of the airport. The Supreme Court of New York County held the motion in abeyance pending a further hearing. The people of statute have an interest in pollution of the state's property. Defendant had no defense because of the duration of the pollution, since there is no prescriptive right to continue wrongdoing. However, since an absolute injunction would close down the airport, the motion would be held in abeyance pending a further hearing on the practicalities of the situation. (Duss-Florida)
W71-04311

LAND DEVELOPMENT, INC V LOUISVILLE GAS AND ELECTRIC CO (LIABILITY FOR FAULTY CONSTRUCTION OF CULVERT DIVERTING STREAM).
459 SWd 150-152 (Ky 1970).

Descriptors: *Kentucky, *Floods, *Alteration of flow, *Culverts, Flood damage, Rain, Rain water, Storm runoff, Streamflow, Reasonable use, Streams, Obstruction to flow, Relative rights, Landfills, Diversion structures, Diversion, Land development, Real property, Land use, Land tenure, Legal aspects, Judicial decisions.
Identifiers: *Injunction (Prohibitory).

Plaintiff city gas and electric utility sought damages from defendant property owners for injuries sustained when defendants' pipeline backed up a stream. In preparing land for construction, defendants has installed a culvert to re-route a stream under their property. Waste matter washed into and stopped up the culvert during unusually heavy rainstorms. Plaintiffs averred defendants creation of this artificial condition had caused the flooding of their property. Defendants contented the rainfalls were an act of God for which they were not liable. The court held that a property owneris liable for flood damages resulting from improper culvert construction where proper construction would have guarded against even unusually heavy rainfalls. The court rejected the defendants act-of-God defense, stating that such an act must be unforeseeable, unpredictable, and of a character which cannot be guarded against. Ruling that the defendants had not made reasonable use of the land, the court affirmed the award of damages to plaintiff. However, a prohibitory injunction against defendant was denied since there had been no showing that flooding would reoccur. (Earl-Florida)
W71-04312

ELKHORN CITY LAND CO V ELKHORN CITY (ABANDONMENT OF WATER WORKS PROPERTY).

459 SW2d 762-765 (Ct App Ky 1970).

Descriptors: *Kentucky, *Land tenure, *Land use, *Water works, Real property, Contracts, Reservoirs, Local governments, Land classification, Landfills, Utilities, Public utilities, Legal aspects, Judicial decisions.

Plaintiff grantor sought reversion of defendant city's interest in property conveyed for water works purposes only. The deed provided for reversion to grantor upon abandonment of the premises for water works use. Plaintiff asserted that defendant's closing of a reservoir and sale of landfill constituted abandonment. Defendant denied abandonment. The Court of Appeals of Kentucky held that the sale of landfill and the closing of a reservoir do not establish abandonment for water works purposes so long as other water work operations continue. Relying on defendant's continued operation of a pumping station, filter plant, and water intake on the property, the court ruled that defendant's actions did not constitute abandonment. The court noted that defendant's sale of landfill did not interfere with the water work's operations in any way. Judgment for defendant was affirmed. (Earl-Florida)
W71-04313

SCANLAN V HOPKINS (LEGAL CONSEQUENCES OF AGREEMENT BY GRANTOR TO CONSTRUCT CULVERT OVER NATURAL WATERCOURSE).
270 A2d 352-357 (Vt 1970).

Descriptors: *Vermont, *Easements, *Land tenure, *Surface runoff, Third party effects, Relative rights, Riddance (Legal aspects), Repulsion (Legal aspects), Drainage, Ponds, Surface waters, Real property, Culverts, Drainage water, Natural flow doctrine, Legal aspects, Judicial decisions, Adjudication procedure.

Plaintiff grantee sought damages from defendant grantor for breach of warranty against encumbrances. Defendant, prior to the conveyance to plaintiff, conveyed property to a third party with a deed agreement that defendant would construct a culvert to conduct surface water to a pond. Defendant subsequently conveyed the land containing the pond to plaintiff. The culvert enclosed but did not alter in any manner a previously existing natural watercourse. Plaintiff contended the deed agreement created a servitude against his property. The Supreme Court of Vermont held an obligation in a deed to a third party to construct a culvert which merely covers over a natural watercourse does not create an easement as to subsequent grantees. The court stated that: (1) doubts regarding easements are resolved against the existence of such easements; and (2) a showing of intention to add benefits to or increase the burden on land, or of the essentiality of an easement to the enjoyment of land is required to establish the existence of an easement. Finding no easement, the court ruled there had been no breach of defendant's covenant. However, the court found plaintiff, as an owner of lower land, obligated to accept the natural discharge of surface water from the culvert into his pond. Judgment for defendant was affirmed. (Earl-Florida)
W71-04314

HANSON V BERT WAY ESTATE (RIPARIAN RIGHTS OF ADVERSE POSSESSOR).
181 NW2d 537-541 (Ct App Mich 1970).

Descriptors: *Michigan, *Riparian rights, *Prescriptive rights, *Islands, Riparian land, Land tenure, Real property, Riparian waters, Relative rights, Rivers, Legal aspects, Judicial decisions, Boundaries (Property), Priorities, Real property.

Plaintiff owner of riverfront property, in part through deed and in part through adverse possession brought action to quiet title to several parcels of land and an island. Plaintiff contended that the riparian rights doctrine vested him with ownership of the island, which was located on his side of the river's thread. The Court of Appeals of Michigan held that in determining the title to an island no distinction is made between a riparian owner acquiring title by deed and one who acquires title through adverse possession. Finding title to the island in the defendant, the court stated that possession sufficient to accord riparian rights, requires merely: (1) occupancy with the intent to control; (2) a ceasing of occupancy, without abandonment, where no other person obtains possession; or (3) the right to immediate occupancy of land, if no other person is in possession. (Earl-Florida)
W71-04315

CITY OF LEXINGTON V LEXINGTON WATER CO (WATER COMPANY'S PROFIT IN LAND SALE NOT RELEVANT IN FIXING RATES).
458 SW2d 778-780 (Ct App Ky 1970).

Descriptors: *Kentucky, *Water rates, *Water works, *Water users, Water costs, Utilities, Land, Administrative agencies, Administrative decisions, Watercourses (Legal), Cities, Condemnation, Public rights, Legal aspects, Judicial decisions, Adjudication procedure.

Plaintiff water company petitioned the Kentucky Public Service Commission for an increase in rates. The city of Lexington protested on the ground that for rate purposes consumers were entitled to benefit from the water company's profit on a sale of land. The city contended that plaintiff had acquired the land by condemnation or threat thereof. The Commission ruled for the city and plaintiff appealed. Affirming a reversal of the Commission's ruling by the lower court, the Court of Appeals of Kentucky held that the sale of land could not be considered by the Commission on petition by the company for an increase in rates. Profit made on the sale of non-depreciable land no longer used in serving the public is not relevant to the fixing of

rates. Customers would not have had to share in any loss on the sale of the land. Neither should they share in any profit. (Duss-Florida)
W71-04316

WILSON V ST REGIS PULP AND PAPER CORP (BOUNDARY LINE BETWEEN PROPERTIES LOCATED ON OPPOSITE SIDES OF STREAM).
240 So 2d 137-144 (Miss 1970).

Descriptors: *Mississippi, *Boundary disputes, *Land tenure, *Thalweg, Channels, Riparian land, Riparian rights, Streams, Sand bars, Sands, Gravels, Damages, Fresh water, Judicial decisions, Legal aspects, Ownership of beds, Beds.

Plaintiff riparian landowner sought to confirm title to a sandbar in a stream as against defendant riparian landowner. Plaintiff's land was located on one side of the stream while defendant's was on the other. Defendant denied that plaintiff owned the land and filed a cross bill for damages for removal of sand and gravel from the sandbar by plaintiff. Both parties agreed that the thread of the stream was the dividing line between their properties. However, plaintiff contended the thread was the thalweg of the channel, while defendant contended it was the line midway between the opposite shorelines when the water is at its ordinary stage. The Supreme Court of Mississippi affirmed a lower court decision for plaintiff. The boundary between properties located along freshwater streams lying wholly within the state is the thalweg or deepest portion of the channel of the stream. The boundary is thus subject to change due to the gradual vagrancies of the stream. The court denied a petition for rehearing. One judge dissented on the ground that the thalweg rule is not applicable to land bounded by freshwater streams within the state. He felt that the boundary should have been a line midway between the shores. (Duss-Florida)
W71-04317

JACOBS V ELWELL (RIGHT TO PREVENT CONSTRUCTION ON BEACH).
151 A 61-62 (NJ 1930).

Descriptors: *New Jersey, *Riparian rights, *Riparian land, *Beaches, Navigable waters, Legislation, Compensation, Land tenure, High water mark, Low water mark, Cities, Legal aspects, Judicial decisions, Construction, Local governments, State governments, Public rights.

The State of New Jersey, on the relation of plaintiff beach property owner, sought a writ of mandamus compelling defendant city building inspector to issue a permit to plaintiff to erect a building on the beach strand. In the original grant of plaintiff's land by the state riparian commissioners, the right was reserved for the city council to define the boundaries of the beach strand and remove and prevent any encroachments on it. This right was given pursuant to statutory authority. Acting upon this grant the city council enacted an ordinance establishing the boundaries of the beach and providing for removal and prevention of encroachments. Plaintiff's proposed building was such an encroachment. The Supreme Court of New Jersey found the statute constitutional and the ordinance valid and denied the petition. (Duss-Florida)
W71-04318

CITYCO REALTY CO V MAYOR, COUNSELOR, AND ALDERMAN OF ANNAPOLIS (RIGHT OF CITY TO DISCHARGE SEWAGE INTO STREAM).
150 A 273-278 (Md App 1930).

Descriptors: *Maryland, *Water pollution, *Sewage disposal, *Cities, Navigable waters, Sewage, Sewers, Municipalities, Public health, Public rights, Streams, Riparian land, Riparian rights, Potable water, Sewage bacteria, Beds, Ownership of beds, Legal aspects, Judicial decisions, Damages, Remedies, Tidal waters, Shores, Sewage effluents, Discharge (Water).

Plaintiff realty company sought to enjoin defendant city of Annapolis from discharging sewage into a creek along which plaintiff owned land. Plaintiff alleged defendant's acts rendered the creek's water unfit for drinking, bathing, and other recreation. Defendant alleged that it had authority to discharge sewage into the creek for the public's benefit. Defendant also denied that its acts caused the pollution, alleging it was due to natural causes. The Court of Appeals of Maryland affirmed a judgment for defendant. Evidence showed that defendant's acts did pollute the creek. However, the condition existed long before plaintiff bought its land, and was doubtless reflected in the price he paid for it. Discharge of sewage by municipalities into tidal waters by authority of the state is not a nuisance. Under such circumstances incidental damage to private owners gives rise to no remedy. The state is the owner of the beds of navigable waters and may grat to municipalities the right to discharge sewage therein. Such a grant would not absolve a municipality of liability where its actions were negligent or indicative of wanton disregard of public or private rights. However, there was no evidence of wantoness or negligence in the instant case. (Duss-Florida)
W71-04319

STATE V PLANT (VIOLATION OF STATUTE PROHIBITING OPERATION OF BOAT FOR HUNTING DURING CERTAIN HOURS).
155 A 35-36 (Me 1931).

Descriptors: *Maine, *Navigation, *Navigable rivers, *Hunting, Game birds, Water utilization, Rivers, Legislation, State governments, Judicial decisions, Legal aspects, Recreation, Navigable waters, Highways, Regulation.

Plaintiff state brought criminal prosecution against defendant duck hunter for violation of game law. The statute prohibited operation of a boat for hunting earlier than one and one-half hours before sunrise. Defendants launched their boat a few minutes before said period, and proceeded downriver to hunt ducks on a distant island. Defendant contended that the operation of the boat at that time was for navigation rather than hunting, and therefore the statute was not violated. The Supreme Judicial Court of Maine noted that the navigable river was open at all hours for lawful business and pleasure, notwithstanding the state authority to control navigable waters for propogation of fish and protection of migratory birds. The court held that plaintiff was without authority to suspend the general use of a navigable river as a public highway. Since defendant had no intention of hunting ducks until he reached the island, he had not violated the statute. (Hart-Florida)
W71-04320

WEST SHORE RR V STATE (LIABILITY FOR APPROPRIATION OF RIVER FLOW FOR NEW CHANNEL OUTSIDE RIVER).
215 NYS 684-689 (1926).

Descriptors: *New York, *Canal construction, *Condemnation, *Alteration of flow, Railroads, Bridges, Piers, Eminent domain, Channel improvement, Canals, Natural flow doctrine, Riparian rights, Riparian waters, Public rights, Compensation, Damages, Diversion, Water level, Streamflow, Navigable waters, Navigable rivers, Navigation, Legal aspects, Water law, Judicial decisions.

Plaintiff railroad sought to recover damages from defendant state for diverting and lowering the waters of a river, thereby exposing and damaging plaintiff's bridge piers and supports. Plaintiff contended that diversion of river waters into a new canal, which lowered the river and exposed the piers and supports to the elements, constituted a taking and appropriation of plaintiff's property. Defendant argued that plaintiff had already been compensated for its land taken and expenses for bridge alterations and that lowering the river for improvement of navigation resulted in consequential damages for which there is no liability. Reversing a judgment for defendant, the Supreme Court of New York noted that the prior condemnation settlement did not include damage to plaintiff's bridge, but only covered the expense of required alterations. The court held that the digging of a new channel outside of the river was not an improvement of navigation within the river to which riparian rights would be subject without a claim for damages, but was an appropriation of the river's flow for use outside of the river and was compensable. (Liptak-Florida)
W71-04321

WIESNER V CITY OF ALBANY (MUNICIPAL LIABILITY FOR TYPHOID EPIDEMIC CAUSED BY DEFECTIVE PIPELINE).
224 App Div 239, 229 NYS 622-626 (1928).

Descriptors: *New York, *Public health, *Water supply, *Epidemics, Cities, Water pollution, Epidemiology, Water pollution sources, Water pollution effects, Diseases, Pipelines, Hudson River, Adjudication procedure, Legal aspects, Judicial decisions, Remedies.

Plaintiff citizen sued defendant city for negligence in causing plaintiff to contract typhoid fever. Defendant's water supply was derived from the severely polluted Hudson River. The water was purified, and pumped under the Erie Canal to the city. The pipe running under the canal, made of thin metal and encased in concrete, rusted through, and waters of the canal, as well as untreated Hudson River water which had overflowed into the canal, passed into the water supply. Defendant had notice of the defective pipe, but failed to notify its citizens that the municipal water was polluted. An epidemic of typhoid broke out. Plaintiff asserted that defendant was liable for his illness by neglecting to repair the pipe or notify its citizens. The Supreme Court of New York noted that plaintiff must show that the typhoid originated in water polluted through defendant's negligence. However, this could be satisfactorily accomplished by showing that bacilli were introduced into plaintiff's system through municipal water, allowing the jury to infer defendant's liability. Determining that the evidence amply supported the jury verdict for plaintiff, the court held defendant liable. (Hart-Florida)
W71-04322

IN RE WATERFRONT OF CITY OF NEW YORK (RIPARIAN RIGHTS SUBJECT TO PUBLIC RIGHT TO IMPROVE NAVIGATION).
231 App Div 597, 248 NYS 190-191 (1931).

Descriptors: *New York, *Riparian rights, *Eminent domain, *Navigation, Navigable waters, Riparian land, Riparian waters, State governments, Cities, Public rights, Piers, Access routes, Roads, Legal aspects, Judicial decisions.

In a city's proceedings to condemn certain riparian lands and riparian rights for navigational purposes, the Supreme Court of New York noted that riparian owners are not entitled to damages for the destruction of piers or the loss of their access to the water. Such rights and privileges are subject to the state's right to make improvements for the benefit of navigation. (Liptak-Florida)
W71-04323

WATER USE IN TENNESSEE, PART D - SUMMARY,
Tennessee Dept. of Conservation, Nashville. Water Resources; and Geological Survey, Nashville, Tenn.
For primary bibliographic entry see Field 06D.
W71-04324

REORGANIZATION PLAN NO. 3 OF 1970 (ENVIRONMENTAL PROTECTION AGENCY).

Hearings. Subcomm of the Comm on Gov't Operations, US House of Representatives, 91st Congress,

2nd Session, July 22, 23, Aug 4, 1970. 209 p, 2 tab, 2 chart, 1 append.

Descriptors: *Adminstrative agencies, *Federal government, *Environment, *Legislation, Ecology, Water pollution, Pollution abatement, Water pollution control, Water quality, Standards, Water pollution effects, Air pollution, Air pollution effects, Pesticides, Research and development, Costs, Coordination, Administration, Management, Planning, Water policy, Public health, Solid wastes, Effluents, Supervisory control (Power).

These hearings before a House subcommittee on government reorganization concerned President Nixon's proposal to create the Environmental Protection Agency (EPA). The President's message to Congress, which also contained a proposed National Oceanic and Atmospheric Administration, outlined the need, functions and organization of the EPA. The EPA would make possible a coordinated attack on water, air, and land pollution. It would undertake functions of many overlapping agencies including: (1) the Federal Water Quality Administration, (2) the National Air Pollution Control Administration, (3) the Bureau of Solid Waste Management, (4) the Bureau of Water Hygiene, and (5) various other agencies concerned with pesticides. Principal functions of the EPA would include: (1) establishment and enforcement of environmental protection standards consistent with national environmental goals, (2) research and data collection on pollution effects and control, (3) assisting other organizations through grants and technical assistance, and (4) assisting the Council on Environmental Quality in developing and recommending policies for environmental protection. Questions from the subcommittee centered on: (1) the need for the EPA, (2) its operation, (3) its effect on other agencies, and (4) inclusion or exclusion of various pollution problems from the agency's activities. (See also W71-04326). (Duss-Florida)
W71-04325

REORGANIZATION PLANS NOS. 3 AND 4 OF 1970.
Hearings, Subcomm on Executive Reorganization and Government Research, Comm on Government Operations, US Senate, 91st Congress, 2nd Session, July 28, 29, Sept 1, 1970. 217 p, 1 tab.

Descriptors: *Administrative agencies, *Federal government, *Environment, *Oceans, Ecology, Water pollution, Pollution abatement, Air pollution, Research and development, Coordination, Administration, Water resources development, Marine fisheries, Commercial fish, Water policy, Standards, Environmental effects, Weather, Atmosphere, Water quality, Public health, Effluents, Estuarine environment, Oceanography, Natural resources, Supervisory control (Power), Legislation.

These hearings before a Senate subcommittee of the Committee on Government Operations concerned President Nixon's proposal to create the Environmental Protection Agency (EPA) and the National Oceanic and Atmospheric Administration (NOAA). The EPA would bring together in a simple organization the major federal pollution control programs in: the Department of Interior; the Department of Health, Education and Welfare; the Atomic Energy Commission; and the interagency Council on Environmental Quality. The EPA's principal functions would be: (1) to establish and enforce environmental protection standards consistent with national environmental goals; (2) to research pollution problems; (3) to assist other organizations in pollution control; and (4) to develop and recommend environmental policies. Combat water pollution would be a major part of these functions. The NOAA would bring together within the Commerce Department the major federal programs dealing with the seas and atmosphere. The function of the NOAA would be to: (1) provide a national oceanic and atmospheric program of research and development; (2) provide assistance to other governmental agencies and private institutions; and (3) insure consideration of environmental protection in development of resources. Many witnesses questioned the method of organization and goals of the two agencies, particularly the NOAA's emphasis on resource development as opposed to environmental protection. (See also W71-04325) (Duss-Florida)
W71-04326

RULES OF PRACTICE AND PROCEDURE.
Delaware River Basin Commission, Trenton, N.J.

Administrative Manual, Part 11, Revised to include Amendments through May 1, 1970. 27 p.

Descriptors: *Delware River Basin Commission, *Administration, *Administrative decisions, *Decision making, Project planning, Water resources development, River basin development, Programs, Water conservation, Non-structural alternatives, Structures, Regulation, Evaluation, Long-term planning, Short-term planning, Water policy, Pollution abatement, Water quality control, Water pollution control, River basin commissions, Interstate commissions, Delware, New Jersey, Administrative agencies, Adjudication procedure.

Part 11 of the Delware River Basin Commission's administrative manual, these regulations govern the procedure for including projects in the Comprehensive Plan and Water Resources Program. Article 1 defines the scope and concept of the six-year comprehensive plan and the procedure for including new projects and reviewing current projects. Article 2 governs the procedure for including projects in the annual Water Resources Programs. Article 3 covers: (1) classification and submission of projects for approval, (2) referral by state and federal agencies, (3) exhibits, (4) hearings, (5) objections, and (6) certification of approval. Objections to proposed projects may not be heard unless filed in detailed writing in advance of hearing. Article 4 prescribes the procedure for reviewing water quality cases. Article 5 governs: (1) the conduct of hearings, (2) timely requests, (3) joint hearings, (4) hearing schedules, (5) authority and power of hearing officers, (6) hearing procedure, (7) testimony, (8) evidentiary rules, (9) record of proceedings, (10) findings and reports, and (11) commission action. Article 6 contains definitions and general provisions as to construction of the preceding articles. (Liptak-Florida)
W71-04327

PEOPLE V TRUSTEES OF FREEHOLDERS (VALIDITY OF PRE-STATEHOOD PATENTS TO BEDS UNDER NAVIGABLE WATERS).
146 Misc 473, 261 NYS 598-605 (1932).

Descriptors: *New York, *Ownership of beds, *Navigable waters, *Land tenure, Boundaries (Property), Lakes, Bays, Beds, Boundary disputes, Real property, Cities, Local governments, State governments, Proprietary power, Leases, Rents, Legal aspects, Judicial decisions.
Identifiers: *Patents (Land), Indians.

Plaintiff state brought action against defendant town to establish title to the beds of various navigable waterbodies. Plaintiff contended that the beds belonged to the state by virtue of its sovereignty, that prior patents to the town were void for failure to acquire title from the Indians, and that prior decisions vesting title in the town were not binding since the state was not a party. The court held that, since it did not appear that the Indians ever had any title to the property in dispute, acquisition of title from the Indians was not a condition precedent to the validity of defendant's patents. The court also held that it was against public policy for the state to assert title in land over which the town had exercised control and from which the town had realized all the rent and profits for over 200 years. Noting that the state had no valid argument, the court said that the prior decisions should be considered controlling. The state's claim was dismissed. (Liptak-Florida)
W71-04328

OYSTERMEN'S DOCK COMPANY V DOWNING (LAND UNDER TIDAL WATERS HELD IN PUBLIC TRUST).

232 App Div 295, 249 NYS 558-559 (1931).

Descriptors: *New York, *Ownership of beds, *Public rights, *Tidal waters, Bays, Beds, Leases, Contracts, Governments, Legal aspects, Cities, Judicial decisions, Beds under water, Remedies, Land tenure.
Identifiers: *Trust doctrine.

Plaintiff dock company brought mandamus to compel defendant town supervisor to execute a lease of land under the waters of Oyster Bay. The court noted that submered tidewater lands are held in public trust. Leasing lands under navigable tide waters must be in the public interest. Since the proposed lease amounted to a conveyance of the fee disguised as a lease, and had been opposed by a public vote, it was against public policy. The court reversed the order requiring defendant to execute the lease. (Liptak-Florida)
W71-04329

BAUMHART V MCCLURE (OWNERSHIP OF RIPARIAN LAND AFTER SUSTAINED SUBMERGENCE).

153 NE 211-212 (Ohio App 1926).

Descriptors: *Ohio, *Land tenure, *Accretion (Legal aspects), *Boundaries (Property), Boundary disputes, Real property, Erosion, Submergence, Adjudication procedure, Riparian land, Lake Erie, Lakes, Judicial decisions, Legal aspects, Avulsion.

Plaintiff riparian lot owner sought to quiet title to riparian land claimed by defendant riparian owner. Defendant's lot was above Lake Erie when it was originally platted. It was later submerged for 40 years, but had recently reappeared. Plaintiff claimed title to the lot by accretion or reliction. The Ohio Court of Appeals defined accretion as an increase in realty by gradual deposit of solid material by water to create dry land. Reliction was defined as an increase in realty by recession of water. Noting that the burden of proof was upon the claimant by accretion as against one having chain of title, the court stated that an owner's title is destroyed by a disappearance of land only when the land is transported beyond the owner's boundary, or is submerged for a period precluding establishment of the property's identity. Furthermore, it was observed that title would not be destroyed by sudden avulsion from storm. Stating that land lost by submergence might be regained by reliction, and its disappearance by erosion could be returned by accretion, the court held that plaintiff had not sustained the burden of proving that defendant's title in the property had been permanently destroyed by its submergence. Defendant's title was held unimpaired. (Hart-Florida)
W71-04330

MEEKER V KAUTZ (TITLE TO ISLANDS IN NAVIGABLE RIVER).
239 NW 27-29 (Iowa 1931).

Descriptors: *Iowa, *Islands, *Accretion (Legal aspects), *Land tenure, High water mark, Rivers, Navigable rivers, Mississippi River, Navigable waters, Beds, Ownership of beds, River beds, State governments, Real property, Water levels, Riparian land, Riparian waters, Boundaries (Property), Boundary disputes, Legal aspects, Judicial decisions, Adjudication procedure.

Plaintiff, claiming title under a patent from the state, sued to quiet title to two small islands in the Mississippi River. Defendant, who owned a third and larger island, contended that the two smaller islands were accretions to his island and that plaintiff's patent description covered only part of the

islands. Affirming a judgment for plaintiff, the Supreme Court of Iowa noted that the burden was on defendant to prove that the islands were formed by accretion, a gradual and imperceptible addition to the shoreline. To prove accretion defendant was required to show that the islands were connected to his land at ordinary high water mark. Since the evidence showed that the three islands were separated by 3 to 4 feet of water when the river was 2 feet below ordinary high water, the court held that defendant had failed to meet his burden. The court also held that certain errors in the patent description were immaterial, since a state patent could not be collaterally attacked by way of defense to a quiet title suit. (Liptak-Florida)
W71-04331

LEHIGH AND WILKES-BARRE COAL MINING CO V PITTSTON COAL MINING CO (DISCHARGE OF HYDRAULIC MINING WATER INTO CONTIGUOUS MINE).
289 Pa 492, 137 A 672-673 (1927).

Descriptors: *Pennsylvania, *Coal mines, *Hydraulic mining water, Hydraulic mine-filling, Hydraulic mining, Mine drainage, Flooding, Tunnels, Tunnel design, Tunnel hydraulics, Tunneling, Ditches, Judicial decisions, Legal aspects.

Plaintiff coal mine owner sought to enjoin defendant coal mine owner from draining water into his mine. Defendant dug a tunnel within 20 ft. of plaintiff's land. To avoid the expense of draining surplus water upward, defendant ditched the tunnel to drain the water through broken rocks into plaintiff's mine. Some 50 years earlier plaintiff's predecessor's mining operation had trespassed into defendant's land, causing the cave-in resulting in the broken rockpile through which the water flowed. Defendant contended that, because of this trespass, plaintiff came with unclean hands and could not complain of the water. Observing that the act of his predecessor 50 years earlier did not affect plaintiff's ability to maintain the action, the Surpeme Court of Pennsylvania held defendant liable and granted the injunction sought. (Hart-Florida)
W71-04332

BOOBER V TOWNE (ROAD DEPARTMENT'S LIABILITY FOR INCREASING THE FLOW OF WATER OVER CONTIGUOUS LAND).
143 A 176-177 (Me 1928).

Descriptors: *Maine, *Road construction, *Natural flow doctrine, *Condemnation, Highways, Alteration of flow, Condemnation value, Compensation, Payment, Eminent domain, Right-of-way, Water injury, Erosion, Flood damage, Damages, Judicial decisions, Legal aspects, Remedies.

Plaintiff landowner sued defendant state highway department for damage caused by excess water flowing over his land. Defendant had repaired the public road crossing plaintiff's land, thereby increasing the flow of water over plaintiff's land. Plaintiff did not allege that the repairs were performed negligently or maliciously. Stating that the condemnation of the right-of-way included the right to maintain and improve the road, even if such improvements increased the flow of water over the contiguous land, the Supreme Judicial Court of Maine observed that plaintiff's compensation for the condemnation included his compensation for the injury. The court held that plaintiff had no cause of action. (Hart-Florida)
W71-04333

APPEAL OF PHILADELPHIA FELT CO (CONDEMNATION VALUE OF RIPARIAN LAND).
143 A 208-209 (Pa 1928).

Descriptors: *Pennsylvania, *Condemnation value, *Hydroelectric plants, *Dams, Eminent domain, Condemnation, Parks, Rivers, Riparian rights, Compensation, State governments, Administrative agencies, Judicial decisions, Legal aspects, Backwater, Recreation.

Plaintiff felt company appealed from an assessment of damages for property condemned for use as a public park. The backwater from plaintiff's downriver dam extended completely through the condemned tract. Plaintiff asserted that the condemnation affected its right to maintain its dam at the present height. The park commissioners contended that there was no intent to interfere with the right to maintain the dam and that such maintenance would not interfere with the park. Determining that park use of the property would not interfere with the dam, the Supreme Court of Pennsylvania held that the board of viewers had properly disallowed damages for interference with the water rights. (Hart-Florida)
W71-04334

STATE WATER CONTROL LAW.
Virginia State Water Control Board, Richmond.

June 1970. 21 p.

Descriptors: *Water quality control, *Virginia, *Water pollution control, Pollution abatement, Water conservation, Legislation, Legal aspects, Social aspects, Water resources development, Municipal wastes, Sewage, Regulation, Water quality, Discharge (Water), Sewage disposal, Waste disposal, Abatement, Taxes.

A compilation of statutes and regulations pertaining to the abatement and prevention of water pollution in Virginia, the Virginia Water Control Law is divided into seven articles encompassing: (1) general statutory provisions; (2) the structure, power and duties of the water control board; (3) regulation of industrial establishments; (4) regulation of sewage discharges; (5) enforcement and appeal procedures; (6) offenses and penalties; and (7) pollution from boats. Regulations and requirements dealing with various aspects of sewage discharge are established by the Virginia Water Control Board. Miscellaneous offenses concerning water pollution include: (1) casting garbage into waters; (2) obstructing or contaminating Virginia waters; (3) throwing trash into or obstructing rivers, creeks, streams, or swamps; and (4) discharge of oil in certain waters. An accelerated amortization rate is established on certain facilities designed to control pollution. (Powell-Florida)
W71-04335

OUTLINE -- ENFORCEMENT OF 1899 REFUSE ACT THROUGH CITIZEN ACTION.
Subcomm on Conservation and Natural Resources of the House Comm on Gov't Operations, 91st Cong, 2d Sess, 1970. 2 p.

Descriptors: *Pollution abatement, *Water pollution control, *Rivers and Harbors Act, *Remedies, Wastes, Water conservation, Legislation, Water resources development, Legal aspects, Social aspects, Water law, Navigable waters, Water pollution, Water policy, Water quality control, Administration, Federal government, Federal jurisdiction.
Identifiers: *Refuse Act of 1899.

The Conservation and Natural Resources Subcommittee of the Committee on Government Operations prepared this brief outline for distribution to citizens interested in preventing pollution and enhancing the quality of United States' waters through citizen action aiding enforcement of the 1899 Refuse Act. The outline is divided into five parts. The first portion of the outline deals with what is prohibited by the Act. This section also defines the term 'refuse'. The second part of the outline covers the authorization and issuance of permits to discharge material into navigable waters. Part three of the outline lists the penalties for violation of the Act. The fourth portion of the material deals with the procedure by which citizens may seek enforcement of the Refuse Act. This portion enumerates the information which should be provided to the United State Attorney in a detailed, notarized statement. The final section of the outline discusses qui tam suits instituted by citizens where the government fails to prosecute a claim within a reasonable period of time. (Powell-Florida)
W71-04336

CHESAPEAKE BAY IN LEGAL PERSPECTIVE,
Maryland Univ., Baltimore. School of Law.
Garret ower.
Estuarine Pollution Study Series 1, Federal Water Pollution Control Administration, Mar 1970. 270 p, 1 tab, 646 ref. FWQA Contract 14-12-421.

Descriptors: *Maryland, *Virginia, *Estuaries, *Legal aspects, Interstate, Legislation, Estuarine environment, Navigable waters, Land tenure, Federal jurisdiction, Federal-state water rights conflicts, State jurisdiction, State governments, Beds, Riparian land, Riparian waters, Local governments, Interstate compacts, Political aspects, Water resources development, Water quality control, Dredging, Fish conservation, Coastal engineering, Judicial decisions.

The Chesapeake Bay is a major east coast interstate estuarine area which has many legal and management characteristics common to other estuarine areas of the United States. This report describes the historical development and resulting complex, interacting legal framework -- at the federal, state, local, and interstate levels -- which regulates development of the Bay's resources. Case studies are presented which relate this legal framework to specific estuarine management problems such as: (1) water quality, (2) withdrawals and diversions, (3) dredging, and (4) dumping. A proposed model statute is presented which may be of assistance to coastal states in improving the planning, development, management, and conservation of estuarine areas. The report is comprehensively referenced and written in a manner understandable to laymen as well as the legally or technically trained reader. (Earl-Florida)
W71-04337

TOWARDS A BETTER USE OF THE OCEAN; CONTEMPORARY LEGAL PROBLEMS IN OCEAN DEVELOPMENT,
Stockholm International Peace Research Inst. (Sweden).
W. T. Burke, R. Bierzanek, I. Brownlie, W. M. Chapman, and C. Girard.
New York, Humanities Press, 1969. 231 p, 2 tab, 263 ref, 4 append.

Descriptors: *International waters, *Law of the sea, *Continental Shelf, *Oceans, International law, Technology, Legal aspects, Marine fisheries, Foreign waters, Economic impact, Political constraints, Commercial fishing, Oceanography, Military aspects, Mineral industry, Boundary disputes, Institutional constraints, Foreign countries, Political aspects, Ownership of beds, Treaties, Research equipment, Buoys, Submarines, Judicial decisions.
Identifiers: *Ocean resources.

The main article of this symposium, a study of contemporary legal problems in ocean development, considers the burdens placed upon existing, international law by technological advances in ocean exploitation. Conflicts arising in specific areas of ocean use are identified, and the legal policy questions within each area are examined. Areas of conflict discussed include: (1) the acquisition of mineral resources, (2) acquisition and control of marine fishery resources, (3) military uses of the continental shelf and the seabed beyond, and (4) scientific research in the oceans. The consequences of claims to special rights by adjacent coastal states and the accelerating trend towards such claims are evaluated. The study also considers possible modes of regulating international fisheries and the exploitation of marine mineral resources. Varying alternatives for accomodating or restricting military use of the oceanic environment are suggested. Finally, the study examines the need for institutional innovations and international accords to protect instruments of scientific research, such as buoys and submersibles, from the restrictions

created by expanded boundary claims. In each area of conflict, the author sets forth appraisals and recommendations. Following the author's study are evaluatory comments and recommendations by seven international scholars. (Earl-Florida)
W71-04338

WATER-USE LAW IN MISSOURI,
Missouri Agricultural Experiment Station, Columbia.
Fred L. Mann, James McLarney, Robert D. Angle, and Frank Miller.
Research Bulletin 889, October 1965. 68 p, 334 ref.

Descriptors: *Missouri, *Water law, *Water utilization, *Riparian rights, Water management (Applied), Administration, Legal aspects, Water rights, Water policy, Judicial decisions, Legislation, Prior appropriation, Preferences (Water rights), Regulation, Surface waters, Streams, Watercourses (Legal), Groundwater, Hydrologic cycle, Riparian waters, Riparian land, Natural flow doctrine, Reasonable use.

Although the legislature has provided regulation of certain water-use aspects, the use of water in Missouri is governed primarily by court decisions applying common law rules. Riparian waters are those waters confined within the banks of a natural watercourse or lake, to which use and access rights attach. The Missouri courts have refused to follow a strict definition of a watercourse. Surveyed is the Missouri case law distinguishing surface waters, overflow waters, water in artificial watercourses, and subterranean waters from riparian waters. Missouri courts have adopted the doctrine of riparian rights but are not committed to either the natural flow or reasonable use theory. Riparian rights may be acquired by prescription in Missouri. Missouri case law concerning alteration of quantity and quality of water flow, flooding, artificial watercourses, navigable waters, ownership of beds, and state jurisdiction over watercourses is examined. With respect to subterranean waters, no Missouri case defines or states a position on percolating water. (Powell-Florida)
W71-04339

RAGAN V SUSQUEHANNA POWER CO (DAMAGES FOR FAILURE TO RELOCATE ROAD FLOODED BY DAM BACKWATER).
146 A 758-760 (Ct App Md 1929).

Descriptors: *Maryland, *Dams, *Roads, *Backwater, Flooding, Bridges, Hydroelectric plants, Maximum probable flood, Design flood, Overflow, Administrative agencies, Administrative decisions, State governments, Eminent domain, Condemnation, Damages.

Plaintiff landowner sued defendant power company for damages caused by defendant's failure to construct a new road to replace one overflowed by the backwater from defendant's dam. The flooding caused plaintiff's route to his property to be longer, which plaintiff alleged reduced the property's value. Defendant had agreed with the county commissioners to relocate public roads and bridges which were flooded. Plaintiff asserted that defendant and the commissioners had conspired to designate the road as private, relieving defendant of a duty to reconstruct it. The Court of Appeals of Maryland observed that the agreement did not require relocation upon new roadbeds. Since plaintiff did have access to his property, the court held that the agreement was not breached and that defendant was not liable. The court furthermore held that plaintiff had failed to prove a conspiracy to defraud. Since mere inconvenience did not constitute a taking, the court held that plaintiff's property had not been condemned. (Hart-Florida)
W71-04340

HALEY V DAVENPORT (CONSTITUTIONALITY OF STATUTE AUTHORIZING TRESPASS TO DRAIN SWAMPS AND PONDS).
168 A 102-103 (Me 1933).

Descriptors: *Maine, *Legislation, *Streams, *Eminent domain, Condemnation, Damages, Ponds, Diatomaceous earth, Dredging, Legal aspects, Judicial decisions, Drainage, Channels.
Identifiers: *Constitutionality.

Plaintiff riparian landowner sued defendant landowner for trespass. Defendant wished to drain a pond upon his land to extract valuable diatomaceous earth and entered plaintiff's land to deepen the stream which drained the pond, under a statute permitting landowners to enter adjacent lands to drain such ponds. Plaintiff contended that the statute unconstitutionally permitted condemnation of private lands for private use. Determining that defendant had unquestionably taken plaintiff's land for his personal benefit under authority of the statute, the Supreme Judicial Court of Maine held the statute unconstitutional and held defendant liable for trespass. The Court noted that appropriation of property for a purpose of great benefit to the public is not for that reason a taking for a public use. (Hart-Florida)
W71-04341

PEOPLE EX REL WESTERN NEW YORK AND P RY V STATE TAX COMM'N (ASSESSMENT OF RAILROAD BRIDGE AS A SPECIAL FRANCHISE).

244 NY 596, 155 NE 911-912 (1927).

Descriptors: *New York, *Railroads, *Bridges, *Assessments, Taxes, Navigable rivers, Nonnavigable waters, Beds, River beds, Ownership of beds, Riparian land, Riparian rights, Administrative agencies, Administrative decisions, Legislation, Compensation, Condemnation, Eminent domain, Judicial decisions, Legal aspects, Government finance.

Plaintiff railroad company brought action to prevent assessment of its bridges across a river as a special franchise. The river was non-navigable in its natural state. Accordingly, title to the beds and shores were alienated by the state. Plantiff purchased a right-of-way in these lands and erected a bridge. Legislation was later enacted declaring the river navigable. Defendant tax commission accordingly assessed plaintiff's bridge as a special franchise. The Court of Appeals of New York observed that the statute, as applied to plaintiff in these circumstances, amounted to a taking without compensation. Therefore, plaintiff's right to erect a bridge was held not to be a special franchise. (Hart-Florida)
W71-04342

GARDEN CLUB OF VIRGINIA V VIRGINIA PUBLIC SERVICE CO (JURISDICTION OF CORPORATION COMMISSION TO GRANT PERMIT FOR DAM ON NON—NAVIGABLE RIVER).
151 SE 161-165 (Sup Ct App Va 1930).

Descriptors: *Virginia, *Dams, *Design flood, *Administrative decisions, Dam construction, Flood control, Hydroelectric plants, Maximum probable flood, Ponding, Administrative agencies, Adjudication procedure, Judicial decisions, Legal aspects, Navigable rivers, Navigable waters, Nonnavigable waters, Rivers, Interstate.
Identifiers: *Interstate commerce.

Plaintiff garden club contested defendant service company's petition to State Corporation Commission for erection of a dam on a non-navigable river. The application was opposed by another company whose plant would be flooded by the design flood. That company induced defendant to lower the dam height slightly to avoid flooding its plant. Since the river was non-navigable, the Commission had jurisdiction of the petition only if defendant's dam would affect interstate commerce. Defendant's original application was subject to the Commission's jurisdiction. With the lowered height, commerce was not affected, and the Commission denied jurisdiction of the petition. Plaintiff contended that defendant had no right to lower the dam height to divest the Commission of jurisdiction. Determining that the change was made for practical purposes, rather than to deprive the Commission of jurisdiction, the Supreme Court of Appeals of Virginia held that the Commission properly dismissed the petition for lack of jurisdiction. (Hart-Florida)
W71-04343

KIRK V PROVIDENCE MILL CO (SURPLUS WATER RIGHTS SUBJECT TO STATE'S RIGHT TO ABANDON AND DRAIN CANAL).

279 US 807, 49 Sup Ct 511 (1929).

Descriptors: *Canals, *Water rights, *Water contracts, *Surplus water, Contracts, Preferences (Water rights), State governments, Ohio, Navigation, Legal aspects, Judicial decisions, Public rights, Eminent domain, Condemnation.

Plaintiff riparian owner sued to enjoin defendant state from draining a canal, thereby destroying plaintiff's surplus water rights in the canal. Plaintiff's predecessor had granted the canal property to the state in exchange for a perpetual grant of surplus water rights. Plaintiff contended that draining the canal was a taking of property without due process or compensation and interfered with his contract rights. Reversing a judgment for plaintiff, the United States Supreme Court held that the grant of water rights was subject to the reserved power of the state to abandon the canal and devote the property to purposes other than navigation. (Liptak-Florida)
W71-04344

DUNBAR V BD OF COMM'RS OF ALBEMARLE DRAINAGE DIST (FAILURE OF DRAINAGE DISTRICT TO ERECT DAM CAUSES CROP FLOODING).
198 NC 487, 152 SE 386-387 (1930).

Descriptors: *Flood damage, *North Carolina, *Dams, *Drainage, Crops, Damages, Water injury, Administrative agencies, Canals, Erosion, Accelerated erosion, Superimposed drainage, Judicial decisions, Legal aspects, Floods.

Plaintiff farmowner sued defendant drainage district for damage to his crops caused by flooding. Plaintiff's farm was contiguous to the drainage canal of the district adjacent to defendant district. In an earlier action between these two drainage districts, defendant was ordered not to discharge more water into the canal contiguous to plaintiff's land than that which flowed into it naturally from defendant. To accomplish this, defendant was ordered to construct a dam. A temporary dam was built pending completion of a permanent structure. The temporary dams were washed out and not rebuilt. Nothing was done to erect a permanent dam. Plaintiff contended that defendant negligently failed to restore the temporary dam or erect the permanent dam, causing the canal to overflow and damage his crops. Affirming the lower court's judgment, the Supreme Court of North Carolina held defendant liable for plaintiff's injury. The court noted that defendant would not have been liable in the absence of negligence. (Hart-Florida)
W71-04345

POST V WILKES-BARRE CONNECTING RR (DESCRIPTION OF CHANNEL AS PROPERTY BOUNDARY WHERE BED LATER DRIES UP).
133 A 377-379 (Pa 1926).

Descriptors: *Pennsylvania, *Ownership of beds, Islands, *Boundary disputes, Navigable rivers, Boundaries (Property), Navigable waters, Rivers,

River beds, Channels, Banks, Sediments, Surveys, Mapping, Riparian land, Riparian waters, Riparian rights, Legal aspects, Judicial decisions, State governments, Railroads, Excavation, Embankments, Sands, Gravels.

Plaintiff riparian owner brought action against defendant railroad for trespassing on and removing soil from land claimed by plaintiff. Plaintiff's deed called for a river as his property line, and the channel adjacent to plaintiff's land had since filled in out to an island in midstream. Plaintiff contended that he now owned up to the channel on the opposite side of the island and that defendant had wrongfully removed soil and built an embankment in what was the old channel. Reversing a judgment for plaintiff, the court held that although descriptions of monuments ordinarily prevail over courses, distances, and quantity, a manifestly inaccurate monument will be discarded where another monument, the bank of the original channel, more correctly corresponds to the described courses, distances, and quantity. The court also noted that, the river being navigable, title to the bed was vested in the state, which granted the franchise to defendant. Plaintiff's deed could not be construed to convey title to state property. (Liptak-Florida)
W71-04346

IN RE LANDS ON UPPER NEW YORK BAY (EASEMENT IN SUBMERGED LANDS EXTINGUISHED BY RESOLUTION OF MUNICIPAL COUNCIL).
215 App Div 438, 214 NYS 234-236 (Sup Ct 1926).

Descriptors: *New York, *Condemnation, *Beds under water, *Cities, Beds, Land tenure, Real property, Ownership of beds, Easements, Roads, Railroads, Eminent domain, Legal aspects, Judicial decisions.

Plaintiff city sought to condemn lands under water extending from a street to the pierhead line. The Supreme Court of New York had formerly decided that since the street extended to the waters edge when the city charter took effect, the city had an easement in the submerged lands between the street lines as extended to the pierhead line. On reargument, it was pointed out that the submerged portion of the street had been closed by resolution of a municipal council. Defendant transit company argued that whatever easement existed in the submerged land was extinguished by the resolution, and could not have existed at the time of condemnation. Plaintiff argued that the conditions necessary for closing the street had not been satisfied, and that therefore the resolution did not extinguish the easement. Presuming that the municipal resolution had satisfied the conditions for closing the street, the court held that the closing of the street extinguished plaintiff's easement therein and that there was no public easement in the lands condemned. (Hart-Florida)
W71-04347

PEOPLE V ZORA REALTY CO (ATTEMPT TO DECLARE PATENT IN SUBMERGED LANDS VOID FOR NONUSE).
128 Misc 523, 220 NYS 40-41 (Sup Ct 1926).

Descriptors: *New York, *Land tenure, *States, *Ownership of beds, Beds, Beds under water, Beneficial use, High water mark, Low water mark, Riparian land, Legal aspects, Judicial decisions.

Plaintiff state brought action to declare a patent of lands between high and low water mark a nullity. Defendant owned the upland adjacent to the disputed property. The patent, issued to defendant 64 years previously, reserved to the people the right to use the premises until the land was used for commerce or the beneficial use of the patentee. No time limit within which the land must have been utilized was expressed in the patent. As defendant had never utilized the land for any purpose, plaintiff contended that the delay was unreasonable, and sought to declare the patent void for nonuse. Holding that the conveyance was in fee, taking effect as to title, at the time of the conveyance, and as to enjoyment when utilized, the Supreme Court of New York granted defendant's motion to dismiss. (Hart-Florida)
W71-04348

IN RE INWOOD HILL PARK (CONDEMNATION OF CITY'S OWN LAND FOR PARK).
219 App Div 478, 220 NYS 298-305 (Sup Ct 1927).

Descriptors: *New York, *Condemnation, *Condemnation value, *Cities, Beds, Beds under water, Ownership of beds, Parks, Land use, Eminent domain, State governments, Legal aspects, Judicial decisions, Land tenure, Compensation, Recreation.

Plaintiff city sought to condemn its own land for a park. The lower court refused to allow an award for plaintiff's land. The submerged land was located between the high water mark and the federal bulkhead line. The Supreme Court of New York said that plaintiff could use its waterfront property for any public purpose and that since the state was empowered to dispose of submerged lands, it could permit plaintiff to do likewise. Holding that plaintiff might condemn the land and assess the award against the property, the court noted that the compensation should be the actual value of the condemned land. Furthermore the court held that a statute declaring plaintiff's rights in the property inalienable did not preclude condemnation. (Hart-Florida)
W71-04349

WHITE V STATE (VALIDITY OF GRANT OF SUBMERGED STATE LANDS).
239 So 2d 484-488 (La App 1970).

Descriptors: *Louisiana, *Ownership of beds, *Navigable waters, *State governments, Beds, Bays, Gulf of Mexico, Land tenure, Leases, Proprietary power, Boundaries (Property), Regulation, Public lands, Public rights, Administrative agencies, Legal aspects, Judicial decisions, Beds under water, Legislation.

Plaintiff landowner sued defendant state to regain possession of a portion of the bed of a navigable bay. Plaintiff based her title on a state transfer of the land to a levee district, a sheriff's sale ordered by the levee district, and two state patents confirming the sheriff's sale. Defendant had subsequently granted mineral leases in the property to an oil company. Defendant contended that the state transfers and patents were null and void because they violated state statutes prohibiting the sale of submerged sovereignty lands. Affirming a judgment for defendant, the Court of Appeal of Louisiana held the first transfer to the levee district void. Statute only authorized the transfer of land, not beds of navigable water. The sheriff's sale was declared void because the levee district had no authority to order the sale. The two state patents were void because they were in violation of a statutory prohibition against the sale or grant of submerged bottoms connected with the Gulf of Mexico. (Liptak-Florida)
W71-04350

6F. Nonstructural Alternatives

FLOOD PROFILE STUDY, HOOSIER CREEK, LINN COUNTY, IOWA,
Geological Survey, Iowa City, Iowa.
For primary bibliographic entry see Field 02E.
W71-03932

FLOOD PLAIN INFORMATION, KIRBY CREEK, GRAND PRAIRIE, TEXAS.
Army Engineer District, Fort Worth, Tex.
For primary bibliographic entry see Field 04A.
W71-04143

FLOOD PLAIN INFORMATION, TRUCKEE RIVER, RENO-SPARKS-TRUCKEE MEADOWS, NEVADA.
Corps of Engineers, Sacramento, Calif.
For primary bibliographic entry see Field 04A.
W71-04144

FLOOD PLAIN INFORMATION, BURCH CREEK, OGDEN, UTAH.
Corps of Engineers, Sacramento, Calif.
For primary bibliographic entry see Field 04A.
W71-04145

ESTABLISHING AN ENGINEERING BASIS FOR FLOOD PLAIN REGULATIONS,
Tennessee Univ., Knoxville. School of Engineering.
For primary bibliographic entry see Field 04A.
W71-04270

6G. Ecologic Impact of Water Development

APPLICATION OF INDUSTRIAL DYNAMICS CONCEPTS TO DECISION MAKING IN ENVIRONMENTAL MANAGEMENT,
Engineering Science, Inc., Oakland, Calif.; and General Behavioral Systems, Los Angeles, Calif.
For primary bibliographic entry see Field 05G.
W71-04025

NATURAL HAZARD IN HUMAN ECOLOGICAL PERSPECTIVE: HYPOTHESES AND MODELS,
Clark Univ., Worcester, Mass. Graduate School of Geography.
Robert W. Kates.
Working Paper No 14, Natural Hazard Research, 1970. 26 p, 5 fig, 14 ref.

Descriptors: *Model studies, *Hazards, Ecology, Computers, Simulation analysis, Management, Decision making, Drought, Water supply.
Identifiers: *Global hypotheses, Human adjustments, East Africa.

This paper was one in a series on research progress in the field of human adjustments to natural hazards. A rudimentary model of the short-run process of adjustment constituted the major focus of the study. The models sought to fashion major hypotheses of hazard behavior into structures capable of computer simulation. Under the global hypotheses of natural hazards such topics as man-nature interaction, techno-social stages, hazard differences, decision-maker differences, individual differences, perception of hazard, awareness of adjustments, and evaluation of adjustments were described. Specific qualities for a model useful for hazard research suggested were that it should be: parsimonious, conservative, flexible, useful, and aesthetically pleasing. The modeling of the ecological perspective within a general systems framework was shown as a single cross-section of space and time. The model contained a human use system and a natural events system which interacted to pose a natural hazard. This generated a set of hazard effects and led to a need for adjustment processes control by use of a managerial adjustment decision model or an aggregate adjustment decision model. The progress being made in modeling drought in East African smallholder agriculture was used as an illustration of the general model other specific hazards mentioned that the human use system could be related to were urban residential development, municipal water supply, etc. (Kriss-Cornell)
W71-04032

NATURE'S LAW AND MAN'S ETHIC,
Army Engineer District, Omaha, Nebr. Design Branch.
For primary bibliographic entry see Field 04C.
W71-04069

A NATIONAL POLICY FOR THE ENVIRONMENT: SELECTED EXCERPTS FROM THE CONGRESSIONAL RECORD AND CONGRESSIONAL DOCUMENTS, FALL, 1969, 91st CONGRESS. 1st SESSION.
Library of Congress, Washington, D.C. Legislative Reference Service.
For primary bibliographic entry see Field 06E.
W71-04092

ENVIRONMENTAL JURISDICTION IN THE CONGRESS AND THE EXECUTIVE,
For primary bibliographic entry see Field 06E.
W71-04106

07. RESOURCES DATA

7A. Network Design

A PROPOSED STREAMFLOW DATA PROGRAM FOR NEW YORK,
Geological Survey, Albany, N.Y.
Kenneth I. Darmer.
Geological Survey Open-file report, 1970. 29 p, 5 fig, 8 tab.

Descriptors: *Streamflow, *Hydrologic data, *Project planning, *New York, Evaluation, Data collection, Gaging stations, Time series analysis, River basins, Network design, Data processing, Watershed management.
Identifiers: *Streamflow data program (N.Y.).

Available streamflow information for New York has been evaluated to provide guidelines for planning needed future programs of data collection and analysis. The evaluation followed three basic steps: (1) quantitative definition of long-term goals for streamflow information, (2) examination and analysis of available data to determine which goals have been attained, and (3) consideration of alternate programs and techniques to most efficiently reach the unattained goals. This evaluation indicates that available data are sufficient for attaining several goals and that significant changes are desirable in the present data-collection program. A future program is proposed for both data collection and data analyses to reach the unattained goals. A map, scale 16 mi per in, shows gaging stations in operation and proposed. Symbols indicate type of station, as for long-term trend, current purpose, and design and planning. (Lang-USGS)
W71-03933

PREDICTION OF SOLAR AND ATMOSPHERIC RADIATION FOR ENERGY BUDGET STUDIES OF LAKES AND STREAMS,
Florida Univ., Gainsville. Dept. of Environmental Engineering.
For primary bibliographic entry see Field 02B.
W71-04020

A CONTRIBUTION TO THE PROBLEM OF SPACING RAINGAUGES IN RUGGED TERRAIN,
Otago Univ., Dunedin (New Zealand). Dept. of Geography.
Peter Hutchinson.
Journal of Hydrology, Vol 12, No 1, p 1-14, December 1970. 14 p, 6 fig, 2 tab, 11 ref.

Descriptors: *Network design, *Rain gages, *Distribution patterns, *Topography, Mountains, Statistical methods, Gaging stations, Data collections, Hydrologic data, Meteorological data, Stations.
Identifiers: *Rain gage networks, *New Zealand.

The areal variability of rainfall is affected by the nature of the terrain, and it is necessary to establish a greater network density in mountainous areas than in flat ones. This paper examines the possibility of establishing quantitative relationships between the 'local relief', used as a measure of the ruggedness of the terrain, and the required network density for given accuracies of estimates for mean catchment rainfall. This is done by comparing the variability of rainfall on three climatically similar areas. Two are in New Zealand, and one is a theoretically derived flat area which is subjected to a statistically similar rainfall regime. The areas chosen were a mountainous area, Coastal Otago, New Zealand, and a flat to rolling area, Coastal Canterbury, New Zealand. The intensity and distribution of 172 actual storms on the two real areas taken on a daily basis were thus mapped, and two parameters, the maximum daily intensity and mean diameter, were measured for each storm. (Knapp-USGS)
W71-04122

7B. Data Acquisition

MEASURING STREAM DISCHARGE USING THE DYE-DILUTION METHOD (CHEMICAL GAUGING),
New Zealand Forest Service, Wellington. Protection Forestry Branch.
Hans M. Keller.
New Zealand Ministry of Works, Water and Soil Division Miscellaneous Hydrological Publication No 2, 1969. 10 p, 1 fig, 2 tab, 5 ref, 3 append.

Descriptors: *Tracers, *Discharge measurement, *Tracking techniques, *Dye releases, Stream gages, Water measurement, Discharge (Water), Analytical techniques.
Identifiers: *Dye-dilution method.

Field and laboratory procedures are given for chemical gaging by the dye-dilution method, using sodium dichromate and a 2-gallon injection container. Injecting at a constant rate, the stream discharge is equal to the dilution ratio multiplied by the injection rate. Practical hints are given for the calibration of the injection rates, the preparation of the initial solution, the precautions to be taken in the field, and the acquisition of quick but accurate results in the laboratory. Forms for use in the field as well as for the analysis in the laboratory are proposed. With clean and careful handling of equipment and chemicals standard errors of about 2 1/2 percent should be obtained. In turbulent mountain streams and small rivers this method has been found suitable, inexpensive, and relatively quick. (Knapp-USGS)
W71-03930

USE OF PORE CASTS AND SCANNING ELECTRON MICROSCOPE TO STUDY PORE GEOMETRY,
Pan American Petroleum Corp., Tulsa, Okla. Research Center.
Edward D. Pittman, and Robert W. Duschatko.
Journal of Sedimentary Petrology, Vol 40, No 4, p 1153-1157, December 1970. 5 p, 2 fig, 15 ref.

Descriptors: *Porosity, *Electron microscopy, *Permeability, *Porous media, *Pores, Interstices, Aquifers, Analytical techniques, Laboratory tests, Percolation, Groundwater movement, Voids.
Identifiers: *Pore geometry.

Various types of pore casts, replicas of void space, useful for the study of pore geometry can be prepared from rocks impregnated with plastic. Conventional light microscopes are suitable for examination of most pore casts; however the scanning electron microscope is definitely superior and is essential for good photographic illustrations. Study of pore casts provides information on the distribution and shape of pores and interconnecting passageways that influence permeability and control the flow of fluids. (Knapp-USGS)
W71-03946

A MECHANICAL DEVICE FOR RELEASING FLUORESCENT TRACERS,
Geological Survey of India, Calcutta. Marine Geology Unit.
P. C. Shrivastava.
Marine Geology, Vol 9, No 5, p M43-M46, December 1970. 4 p, 2 fig, 11 ref.

Descriptors: *Tracers, *Dye releases, *Sands, *Bed load, *Sediment transport, Bottom sediments, Equipment, Instrumentation, Tagging, Tracking techniques, Fluorescence.
Identifiers: Tracers (Fluorescent sand).

An oil drum may be made into a mechanical device for the release of more than 250 kg of fluorescent tracer sand under water on the bottom. The device basically consists of a drum with a false-bottom and a release mechanism which opens the bottom on touching the sediment surface. When the drum is lifted a little, the false-bottom opens allowing the tracer sand to deposit on the bottom at the sediment surface. The drum has been used successfully in a number of tracer investigations of the Geological Survey of India in varying operational conditions at sea and in tidal estuaries where the currents were very strong. (Knapp-USGS)
W71-03949

ESTIMATION OF SEA SURFACE TEMPERATURE FROM SPACE,
Michigan Univ., Ann Arbor. Inst. of Science and Technology.
D. Anding, and R. Kauth.
Remote Sensing of Environment, Vol 1, No 4, p 217-220, December 1970. 4 p, 6 fig, 1 tab, 3 ref. NASA Contract No NAS 12-2117.

Descriptors: *Water temperature, *Remote sensing, *Infrared radiation, Satellities (Artificial), Data collections, Weather forecasting, Synoptic analysis.
Identifiers: *Infrared radiometry.

A procedure for obtaining improved estimates of water surface temperature uses spatially scanning space-borne systems to perform simultaneous radiometric measurements in two wavelength intervals in the thermal infrared atmospheric-window spectral regions. The procedure reduces errors in the estimate of water surface temperature caused by haze and water vapor effects from approximately 2.0 deg C to approximately 0.15 deg C. (Knapp-USGS)
W71-03959

RADIOMETRIC INVESTIGATIONS ON THE BEACH AT THE MOUTH OF THE KURA RIVER,
For primary bibliographic entry see Field 02J.
W71-03962

REMOTE GROUNDWATER LEVEL METER FOR BOG STATIONS,
V. I. Yakovlev.
Translated from Trudy Gos Gidrol Inst-ta, No 172, p 70-79, 1969. Soviet Hydrology: Selected Papers, No 5, p 442-449, 1969. 8 p, 6 fig.

Descriptors: *Bogs, *Water levels, *Telemetry, *Observation wells, *Gages, Water level fluctuations, Instrumentation, Surveys, Data collections, Gaging stations, Stations, Water wells.
Identifiers: Bog water-levels.

A new remote-reading meter for measuring water levels in bogs consists of several sensors, a control panel with power supply sources, and a communication line. Float sensors (up to 10), which perceive the changes in groundwater level, are installed in measuring wells. The control panel is located in the station building. It signals the wells and measures the groundwater levels at their sites. The scale readings give the direct values of the level in the wells from the bog surface and do not require further processing. There is no need for

heating and thermally insulating the well after each observation in winter. (Knapp-USGS)
W71-03966

ROD-MOUNTED BOTTOM GRAB,
N. Ya. Solov'yev.
Translated from Trudy Gos Gidrol Inst-ta, No 172, p 96-99, 1969. Soviet Hydrology: Selected Papers, Issue No 5, p 450-452, 1969. 3 p, 2 fig.

Descriptors: *Bottom sediments, *Sampling, Dredging, Equipment, Sediments, Mud, Sands.
Identifiers: *Bottom-sediment samplers.

A rod-mounted bottom grab is designed to sample bottom sediments 30-50 mm thick without disturbing structure. The instrument takes samples of noncohesive silt and sandy-gravelly deposits from the bottom of rivers, canals, lakes, and reservoirs in water depths of up to 2 m and at flow velocities to 2 m/sec. The volume of the sample when the grab is full is 300 cc. The device weights 3.5 kg and measures 450 x 159 x 132 mm. The bottom grab is designed to operate with one or two sets of hydrometric rods. The operating principle of the bottom grab is based on the mechanical separation of the sediment sample from the bottom of a body of water by a rotating scoop. (Knapp-USGS)
W71-03967

SPECTROPHOTOMETRIC DETERMINATION OF CHLORATE ION,
Missouri Univ., Columbia. Dept. of Chemistry.
For primary bibliographic entry see Field 02K.
W71-03994

UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME I. STATE-OF-THE-ART OF OCEANOGRAPHIC AND METEOROLOGICAL SENSORS, TUTORIAL DISCUSSION,
Texas Instruments, Inc., Dallas. Services Group.
Robert J. Gaillard, Kenneth I. Heldebrandt, Robert M. Crosby, and Thomas Cass.
Available from NTIS as AD-711 322, $3.00 in paper copy, $0.95 in microfiche. Rept. No TI-59009-1a, 21 May 70. 213 p, 105 ref. Contract DOT-CG-90505-A.
Identifiers: *Sensors, State-of-the-art reviews, *Meteorological parameters, Sensors, *Oceanographic data, Transducers, Underwater sound equipment, Pressure gages, Optical instruments, Termistors, Oceanographic equipment, Digital systems, Specifications, Probes, Coast Guard research.

This volume presents the findings of the task by presenting Coast Guard operational requirements and summarizing conclusions in a descriptive evaluation for each parameter. The present state-of-the-art of oceanographic sensor technology is tabulated as related to the operational requirements established by the Coast Guard as a basis for the study. These operational requirements are, in themselves, ambitious goals. However, as a result of the knowledge gained in performing this study, the requirements may be scaled; alternatively, by identifying the inability of present instruments to meet the requirements, an incentive is established for accomplishing the necessary development work needed to meet the goal. Measurement discussion is provided for each parameter to be used as background information for the prospective instrument user. There are also brief general discussions on signal conditioning and encoding techniques and on power sources. The measurement of each parameter is discussed in the following sequence: General, indicating usual measurement requirements and defining (where deemed necessary) the terms associated with the measurements; Transducer types associated with the measurements; and State-of-the-art, frequently including some speculation about the course of future developments. The discussion of each measurement is not intended to be comprehensive but only tutorial to the point that a person involved with the measurement for the first time can comprehend the type, purpose, and techniques utilized to make the measurement. For those readers who wish to pursue the subject in greater depth, there is an extensive bibliography of material related to each measurement. The final section indicates the relative costs of different measurement techniques for each parameter. It does not provide actual price information because price is so highly dependent on the terms of a specific purchase order. (See also W71-04010 thru W71-04014)
W71-04009

UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME II. STATE-OF-THE-ART OF OCEANOGRAPHIC AND METEOROLOGICAL SENSORS, CATALOG,
Texas Instruments, Inc., Dallas. Services Group.
Robert J. Gaillard, Kenneth I. Heldebrandt, and Robert M. Crosby.
Available from NTIS as AD-711 323, $3.00 in paper copy, $0.95 in microfiche. Report No TI-59009-1b, 21 May 70. 354 p. Contract DOT-CG-90505-A.
Identifiers: *Sensors, State-of-the-art reviews, *Meteorological instruments, Catalogs, *Oceanographic data, Sensors, Optical instruments, Underwater light, Underwater sound, Ocean currents, pH, Salinity, Underwater communication systems, Dew point, Television communication systems, Atmospheric temperature, Cloud cover, Power supplies, Costs, Operation, Coast Guard research.

The primary function of Volume II is to present catalog listings indicating a broad spectrum of available off-the-shelf hardware. Proprietary interest has unfortunately prevented the inclusion of several state-of-the-art sensors in the catalog listings. Inadvertent omissions of available sensors and recent advances in sensor technology may also have occurred. By questionnaires and telephone calls, 178 manufacturers were contacted; 100 responded. Similarly, 58 questionnaires were mailed to users of oceanographic instruments, with 20 replying. Visits were made to major manufacturers and users to amplify material received and to ascertain the direction of development not yet published. Additionally, all catalog sheets were forwarded to the manufacturer for his final review before being incorporated into the catalog; therefore, all accuracy statements in the catalog section are those currently being quoted by the manufacturer. This report summarizes the state-of-the-art of oceanographic and meteorological instrument technology in the year 1970 and provides the bases by which, if maintained, an up-to-date catalog of sensor availability can be referenced by future designers. (See also W71-04009)
W71-04010

UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME III. THE SURVIVAL ENVIRONMENT FOR OCEANOGRAPHIC AND METEOROLOGICAL SENSORS,
Texas Instruments, Inc., Dallas. Services Group.
Robert M. Crosby, Frank H. MacDonald, Thomas R. Livermore, and William Gumma.
Available from NTIS as AD-711 325, $3.00 in paper copy, $0.95 in microfiche. Report No TI-59009-2, 21 May 70. 123 p, 28 ref. Contract DOT-CG-90505-A.
Identifiers: *Sensors, Protection, *Oceanographic data, Sensors, *Meteorological parameters, Corrosion, Fouling, Hydrostatic pressure, Vibration, Thermal shock, Survival, Radiofrequency interference, Coast Guard research, Sea water environment.

Task 2 describes the operational, transport, and storage environments for oceanographic and meteorological field instruments. The study resulted in recommendations for environmental protection and called attention to areas needing further work in order to accomplish adequate sensor protection at sea. (See also W71-04009)
W71-04011

UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME IV. THE FORMATTING AND TRANSMISSION OF DATA FROM OCEANOGRAPHIC SENSORS,
Texas Instruments, Inc., Dallas. Services Group.
Wilton J. Daniel, Jr., and Jerry R. Yeargan.
Available from NTIS as AD-711 326, $3.00 in paper copy, $0.95 in microfiche. Report No 59009-3, May 21, 1970. 165 p, 55 ref. Contract DOT-CG-90505-A.
Identifiers: *Sensors, *Data transmission systems, *Oceanographic data, Sensors, *Meteorological parameters, Data processing systems, Signal-to-noise ratio, Amplitude modulation, Bandwidth, Multiplex, Stabilized platforms, Buoys, Underwater, State-of-the-art reviews, Tables, Coast Guard research, Data acquisition.

The report examines the problem of transmitting oceanographic data from underwater sensors to a variety of surface platforms as constrained by operational requirements set forth by the United States Coast Guard. Recommendations concerning a system to meet these requirements are made. The report also examines the formats necessary to convey the information collected from the platforms to users of both perishable and archived data. (See also W71-04009)
W71-04012

UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME V. ANALYSIS OF APPLYING STANDARDIZATION TECHNIQUES TO OCEANOGRAPHIC SENSORS,
Texas Instruments, Inc., Dallas. Services Group.
P. David Call, and J. Daniel Wilton, Jr.
Available from NTIS as AD-711 327, $3.00 in paper copy, $0.95 in microfiche. Report No 59009-4, June 3, 1970. 54 p, 9 ref. Contract DOT-CG-90505-A.
Identifiers: *Sensors, Standarization, *Oceanographic data, Sensors, *Meteorological parameters, Design, Standards, Specifications, Reliability (Electronics), Reliability, Maintainability, Coast Guard research.

The report examines the areas in which oceanographic sensors can be standardized to meet the operational requirements set forth by the United States Coast Guard. Recommendations are made for areas in which cost reductions can be realized through the use of standards. (See also W71-04009)
W71-04013

UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME VI. TEST REQUIREMENTS FOR OCEANOGRAPHIC AND METEOROLOGICAL SENSORS,
Texas Instruments Inc., Dallas. Services Group.
Frank H. MacDonald, Lawrence B. Sullivan, and Thomas R. Livermore.
Available from NTIS as AD-711 328, $3.00 in paper copy, $0.95 in microfiche. Report No TI-59009-5, May 31, 1970. 193 p, 6 ref. Contract DOT-CG-90505-A.
Identifiers: *Sensors, Reliability, *Oceanographic data, Sensors, *Meteorological parameters, Performance (Engineering), Environmental tests, Production control, Handling, Storage, Transportation, Design, Coast Guard research.

Task 5 was concerned with the development of test and calibration techniques required to measure the sensor compliance with the performance, mechanical, and electrical specifications. A test program was written that provides for a rigorous examination of each basic sensor design as it applies to performance in the operational environment and its ability to survive the environmental imposed by storage, transportation, predeployment, and deployment handling. (See also W71-04009)
W71-04014

NEW CHART OFFERS FAST PERMEABILITY ESTIMATE,
California Univ., Berkeley.

J. Kumar.
World Oil, Vol 172, No 2, p 38, February 1, 1971. 1 p, 4 ref.

Descriptors: *Permeability, *Electrical well logging, Resistivity, Borehole geophysics, Aquifers, Porosity, Porous media, Saturated flow.
Identifiers: Specific permeability.

Specific permeability can be found quickly and easily from electric log data using an empirical formula developed from experimental work with several different types of sandstones. Results compare closely with core analysis in many cases. This equation is valid only for clean (shale free) and preferentially water wet sands. The solution to this equation is plotted on an accompanying chart. (Knapp-USGS)
W71-04110

RECONSTRUCTION OF SUBGLACIAL RELIEF FROM RADIO ECHO SOUNDING RECORDS,
Scott Polar Research Inst., Cambridge (England).
For primary bibliographic entry see Field 02C.
W71-04112

A RAPID METHOD OF COMPUTING AREAL RAINFALL,
Aston Univ., Birmingham (England).
T. R. E. Chidley, and K. M. Keys.
Journal of Hydrology, Vol 12, No 1, p 15-24, December 1970. 10 p, 4 fig, 2 tab, 2 ref.

Descriptors: *Rain gages, *Rainfall, *Depth-area-duration analysis, *Distribution patterns, Data processing, Hydrologic data, Meteorological data, Data collections, Statistical methods, Least squares methods, Monte Carlo method, Isohyets.
Identifiers: *Rainfall distribution.

A polynomial surface is fitted to the recorded rainfall for a given time period. This polynomial is integrated over the area of interest. The result is a set of weights for each gage which, when multiplied by the observed rainfall at each gage give the total volume of rainfall on the area. Once the weights have been determined for a given gage network and area the method is suitable for hand computation. (Knapp-USGS)
W71-04123

THE UNIVERSALISATION OF THE CO-ORDINATES OF LOGARITHMIC WEIR PROFILES,
Indian Inst. of Science, Bangalore. Dept. of Civil and Hydraulic Engineering.
D. Chandrasekaran, and N. S. Lakshmana Rao.
Journal of Hydraulic Research, Vol 8, No 4, p 395-402, 1970. 8 p, 2 fig, 1 tab, 2 ref.

Descriptors: *Calibrations, *Weirs, *Discharge measurement, *Stream gages, *Stage-discharge relations, Discharge (Water), Surface waters, Streamflow.
Identifiers: *Weirs (Logarithmic section).

Logarithmic weirs in which discharge varies as the logarithm of head, have less relative error in discharge computation for a given relative error committed in head measurement than other weirs. It is desirable to have universalized coordinates of complicated weir profile equations, especially when a trial and error procedure is involved in the selection of a suitable size of a particular type of weir for measuring a specific discharge. Universalization of the coordinates of logarithmic weirs was calculated and tabulated. (Knapp-USGS)
W71-04127

ISOTOPE HYDROLOGY, 1970.
International Atomic Energy Agency, Vienna (Austria).
For primary bibliographic entry see Field 02A.
W71-04133

DETECTION OF PRECIPITATION BY RADAR,
Royal Observatory, Hong Kong. Div. of Research and Climatology.
P. C. Chin.
In: Forecasting of Heavy Rains and Floods, Proc Joint Seminar of Regional Associations 2 and 5 of World Meteorological Organization, Nov 11-23, 1968, Kuala Lumpur, Malaysia, published by World Meteorological Organization, Geneva, p 27-43, 1970. 17 p, 3 fig, 2 tab, 20 ref.

Descriptors: *Remote sensing, *Radar, *Weather forecasting, *Weather patterns, *Precipitation (Atmospheric), Instrumentation, Reviews, Meteorology.
Identifiers: *ECAFE, *Asia.

General factors which affect the use of radar for the detection of precipitation are reviewed. The common method used in the measurement of the rate of precipitation is based on the statistical relationship between the intensity of precipitation and the reflected power from the precipitation elements received by the radar. Radar is especially useful for detecting and measuring precipitation in areas where rain gages are sparsely distributed or where localized heavy rainfall frequently occurs. Since the radar system usually permits an integration of precipitation amounts over time and area to be made by electronic or other means, its application is of particular importance in hydrological operations such as flood forecasting, dam control and others. (Knapp-USGS)
W71-04154

SURVEY OF OBJECTIVE METHODS USED IN HONG KONG FOR PREDICTING TYPHOON MOVEMENT,
Royal Observatory, Hong Kong. Div. of Research and Climatology.
For primary bibliographic entry see Field 02B.
W71-04158

REARING DEVICES FOR STREAM INSECT LARVAE,
Federal Water Pollution Control Administration, Cincinnati, Ohio. Analytical Quality Control Lab.
William T. Mason, Jr., and Philip A. Lewis.
The Progressive Fish-Culturist, Vol 32, No 1, p 61-62, January 1970. 2 fig, 1 ref.

Descriptors: *Laboratory techniques, *Larvae, *Laboratory equipment, Mayflies, Caddisflies, Midges, Insects, Aquatic insects.
Identifiers: *Rearing device, Odonates.

Photographs and descriptions are given for two types of stream larvae rearing devices, an aquarium and magnetic stirrer, and a gravity flow device. These devices are used in the Analytical Quality Control Laboratory of the Federal Water Quality Administration for rearing stream mayflies, caddisflies, midges, and odonates. Procedures for setting up the devices and for rearing the larvae are described. (Little-Battelle)
W71-04190

EVALUATION REPORT 1: AUTOMATIC BEAKER SAMPLE CHANGER,
Federal Water Pollution Control Administration, Cincinnati, Ohio. Analytical Quality Control Lab.
L. B. Lobring, and R. L. Booth.
Available from: EPA, WQO, Analytical Quality Control Laboratory, 1014 Broadway, Cincinnati, Ohio 45202. January 1970. 5 p, 2 fig, 2 tab, 1 ref.

Descriptors: *Chemical analysis, *Automation, *Laboratory equipment, Surface waters, Cost, Comparison, Time, Hydrogen ion concentration, Fluorides.
Identifiers: *Beaker Butler.

The Beaker Butler, manufactured by Vision Laboratories, Inc., Oriskany, New York, is a prototype sample changer that presents liquid samples to a variety of electrodes. To evaluate the potential use of this equipment for routine analyses, samples were analyzed using this equipment as well as manual methods. The results, which are included in tables, show that the automated step gave results comparable to manual methods with a significant reduction in cost and man hours. (Little-Battelle)
W71-04192

USE OF A FLOATING PERIPHYTON SAMPLER FOR WATER POLLUTION SURVEILLANCE,
Federal Water Pollution Control Administration, Cincinnati, Ohio. Analytical Quality Control Lab.
For primary bibliographic entry see Field 05B.
W71-04194

METHODS OF COLLECTION AND ANALYSIS OF PLANKTON AND PERIPHYTON SAMPLES IN THE WATER POLLUTION SURVEILLANCE SYSTEM,
Federal Water Quality Administration, Cincinnati, Ohio. Analytical Quality Control Lab.
For primary bibliographic entry see Field 05A.
W71-04195

ELIMINATION OF 'MEMORY' PEAKS ENCOUNTERED IN AQUEOUS-INJECTION GAS CHROMATOGRAPHY,
Federal Water Pollution Control Administration, Cincinnati, Ohio. Analytical Quality Control Lab.
Ronald C. Dressman.
Journal of Chromatographic Science, Vol 8, p 265, May 1970. 2 fig, 4 ref.

Descriptors: *Gas chromatography, *Analytical techniques, Laboratory equipment, Phenols, Organic matter.
Identifiers: *Chemical interference, Memory peaks.

The source was investigated of 'memory peaks' which interfere with analysis during gas chromatography. The tests were conducted using phenols and organic acids. The results indicated that the major portion of the 'memory peaks' resulted from holdup in the injection port. A small portion, approximately 4% of the original response, was attributed to sorption at the head of the column. An advanced injection port was designed such that the carrier gas would sweep the entire injection chamber so that 'memory peaks' would be prevented or at least greatly reduced. On-column injection was combined with this design to further eliminate the possibility of sorption of material on the metal surface of the injection block since use of such material could also result in 'memory peaks'. Tests using on-column injection with an injection port effectively prevented 'memory peaks' produced by phenols and eliminated the need for water flushing after each sample or standard injection. In the case of organic acids, the system reduced the 'memory peaks' to about 4% of the original response. These peaks were completely eliminated with just one water flush. The redesigned injection block is illustrated. (Little-Battelle)
W71-04196

ANALYTICAL INSTRUMENTS IN WATER POLLUTION CONTROL,
Federal Water Pollution Control Administration, Cincinnati, Ohio. Analytical Quality Control Lab.
For primary bibliographic entry see Field 05A.
W71-04205

A LIMESTONE-FILLED, ARTIFICIAL SUBSTRATE SAMPLER-FLOAT UNIT FOR COLLECTING MACROINVERTEBRATES IN LARGE STREAMS,
Federal Water Pollution Control Administration, Cincinnati, Ohio.
William T. Mason, J. B. Anderson, and George E. Morrison.
The Progressive Fish-Culturist, Vol 29, No 2, April 1967. 74 p, 2 fig.

Descriptors: *Macroinvertebrates, *Sampling, Limestone, Equipment, Floats, Sampling.
Identifiers: *Artificial substrates, Euphotic zone, Basket sampler, Sample preservation, FWQA methods.

The Water Pollution Surveillance System uses a cylindrical, welded-wire, chromium plated 'Bar-B-Q' basket filled with limestone and suspended from a polyurethane filled float to collect macroinvertebrates in large streams. The basket is 7 inches in diameter and 11 inches long. Experience indicates that the optimum exposure is about 6 weeks at a 5 foot euphotic zone depth. The organisms are removed from the rocks in water with a stiff-bristled brush, washed in a No. 30 Sieve, bottled, and preserved in 70 percent ethanol or 5 percent formalin. Macroinvertebrates are recorded as number-per-sampler. (McCann-Battelle)
W71-04219

SOIL FREEZING DETERMINED WITH FOUR TYPES OF WATER-FILLED TUBES,
Forest Service (USDA), Ogden, Utah. Intermountain Forest and Range Experiment Station.
Norbert V. De Byle.
USDA Forest Serv Res Note INT-127, December 1970. 8 p, illus.

Descriptors: *Freezing, *Soil temperature, *Soil moisture meters, *Soil water, Snow cover, Thermal properties, Frozen soils, Permafrost, Thawing, Frozen ground, Heat transfer, Instrumentation, Measurement, Estimating, Nuclear moisture meters, Utah.

During two winters (1966-67 and 1967-68) periodic determinations were made of soil temperatures and ice column depths in four types of tubes inserted in the soil at three sites in northern Utah. The 0C. isotherm varied in depth from the surface to 21 inches at lower elevation sites in Logan and to 41 inches on an exposed mountain ridge at 8,870 feet elevation. Steel tubing (1.55-inch inside diameter), commonly used as access tubes for neutron probes used in soil-water measurements, proved to be as good as steel or plastic pipe as casings for water-filled frost meter tubes. (De Byle, Forest Service)
W71-04251

HALF-MINUTE COUNTS FOR NEUTRON PROBES,
Forest Service (USDA), Fayetteville, Ark. Southern Forest Experiment Station.
T. L. Rogerson.
Soil Science, Vol 110, No 5, p 359-360, November 1970.

Descriptors: *Nuclear moisture meters, Performance, Evaluation.
Identifiers: Am Be source.

Counting intervals of one minute have been widely used to determine soil water content with neutron probe systems. Half-minute counting intervals have been found to be as precise as minute intervals for all practical purposes when using late model systems with 100 mc. Am Be sources. (Rogerson-Forest Service)
W71-04259

7C. Evaluation, Processing and Publication

ANALYSIS OF STOCHASTIC HYDROLOGIC SYSTEMS,
Illinois Univ., Urbana.
For primary bibliographic entry see Field 02A.
W71-03869

GROUNDWATER RESOURCES OF COLLINGSWORTH COUNTY, TEXAS,
Geological Survey, Austin, Tex.
For primary bibliographic entry see Field 02F.
W71-03935

WATER-QUALITY DATA FOR THE FLAMING GORGE RESERVOIR AREA, UTAH AND WYOMING,
Geological Survey, Salt Lake City, Utah.
R. J. Madison.
Utah Basic-Data Release No 20, 1970. 33 p, 4 fig, 4 tab, 4 ref.

Descriptors: *Water quality, *Reservoirs, *Utah, *Wyoming, *Chemical analysis, Water analysis, Water properties, Depth, Vertical migration, Seasonal, Streams, Streamflow, Discharge measurement, Statistical methods, Correlation analysis, Data collections, Hydrologic data.
Identifiers: *Flaming Gorge Reservoir (Utah and Wyo.), Chemical Concentration relationships, Weighted-Average Concentrations.

This is a basic-data report of water quality in Flaming Gorge Reservoir in Utah and Wyoming. The construction of Flaming Gorge Dam began in 1957, and the reservoir began storing water in November 1962. This report tabulates the chemical-quality data which were collected during the study (1966-68) and summarizes some of the data available prior to closure of the reservoir. Three sets of data were collected from the reservoir during the study. The sampling locations and the data are shown. At each of the 13 collection sites in the reservoir, samples were collected at various depths from the surface to the bottom. Samples for complete chemical analysis were collected from 6 sites at both the beginning (October 1966) and the end (September 1968) of the data-collection phase of the study. The variation in dissolved ions with depth for these two sets of data are summarized. Samples for partial analysis were collected from 9 sites in September 1967, and the partial analyses are tabulated. Chemical-quality and water-discharge data were also collected from 19 sites on the minor tributaries to the reservoir during the summer and fall of 1967. These data are listed in 2 tablex and are summarized in graphs. Summary graphs of the mean annual weighted-average concentrations of selected constituents for the period 1957-67 are included. (Woodard-USGS)
W71-03936

COMPARISON OF THE DESCRIPTORS OF SEDIMENT GRAIN-SIZE DISTRIBUTIONS,
Northwestern Univ., Evanston, Ill.
For primary bibliographic entry see Field 02J.
W71-03947

MAP OF TOTAL STREAMFLOW FROM THE TERRITORY OF THE SOVIET UNION,
Akademiya Nauk SSSR, Moscow. Institut Geografii.
For primary bibliographic entry see Field 02E.
W71-03960

DETERMINATION OF THE DISTRIBUTION OF RAINFALL FLOODS IN LARGE CATCHMENTS USING HYDROMETEOROLOGICAL DATA,
Meteorological Office, New Delhi (India).
For primary bibliographic entry see Field 02E.
W71-03977

EVALUATION OF MAXIMUM RAINFALL DISCHARGE FROM A REGION OF DEFICIENT RAINFALL DATA,
Dum Dum Airport, Calcutta (India); and Meteorological Office, New Delhi (India).
For primary bibliographic entry see Field 02E.
W71-03978

DETERMINATION OF MAXIMUM FLOOD FLOW AND THE PROBABILITY OF ITS BEING EXCEEDED, USING INCOMPLETE INFORMATION (FRENCH),
Electricite de France, Chatou. Centre de Recherches et d'Essais.
For primary bibliographic entry see Field 02E.
W71-03979

CONSTRUCTION OF THE UNIT HYDROGRAPH BY THE METHOD OF HYDROLOGIC ANALOGY (FRENCH),
Research Inst. for Water Resources Development, Budapest (Hungary); and Transdanubian Water Authority, Szekesfehervar (Hungary). Water Management.
For primary bibliographic entry see Field 02E.
W71-03981

DETERMINATION OF MAXIMUM FLOW AND FLOOD HYDROGRAPHS (FRENCH),
National Office of Irrigation, Rabat (Morocco).
For primary bibliographic entry see Field 02E.
W71-03985

PRACTICAL METHODS OF ESTIMATING MAXIMUM FLOODS (FRENCH),
Consejo Superior di Investigaciones Cientificas, Madrid (Spain). Instituto de Hidrologia.
For primary bibliographic entry see Field 02E.
W71-03990

WATER MEASUREMENT PROCEDURES - IRRIGATION OPERATORS' WORKSHOP.
Bureau of Reclamation, Denver, Colo. Engineering and Research Center.
For primary bibliographic entry see Field 08B.
W71-04007

QUALITY OF SURFACE WATERS OF THE UNITED STATES, 1965: PARTS 7 AND 8. LOWER MISSISSIPPI RIVER BASIN AND WESTERN GULF OF MEXICO BASINS.
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02K.
W71-04048

COMPUTER AIDS GROUNDWATER RESOURCES RESEARCH PROJECT,
Arizona Univ., Tucson. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 02F.
W71-04057

OPTIMUM FIRE POWER OUTPUT FROM A TWO RESERVOIR SYSTEM BY INCREMENTAL DYNAMIC PROGRAMMING,
California Univ., Los Angeles. School of Engineering and Applied Science.
For primary bibliographic entry see Field 04A.
W71-04111

CATALOG OF INFORMATION ON WATER DATA, EDITION 1970 - INDEX TO WATER QUALITY SECTION.
Geological Survey, Washington, D.C. Office of Water Data Coordination.

Geological Survey Water Data Catalog, 1970. 443 p, 2 fig, 2 exhibits, 4 tab.

Descriptors: *Data collections, *Hydrologic data, *Water quality, *Documentation, *Data storage and retrieval, Networks, Monitoring, Sampling, Maps, Instrumentation, Stations, Libraries, Investigations.
Identifiers: *Catalog of Information on Water Data.

An index is presented for use in retrieving water quality data from the Catalog of Information on Water Data, a record of activities in water data collection in the U.S. The Catalog is a file of information that is accessible through data-retrieval procedures--it contains information about water-data acquisition activities but does not contain the actual data, which must be obtained from the reporting agencies. Input to the Catalog consists of information supplied by Federal, State, and local agencies that acquire water data directly in the field and laboratory. All information is stored on media suitable for data processing, supplemented

by microforms and maps. Information from the Catalog (output) is made available through indexes such as this publication, which is the index to the water quality section of the Catalog. This index reflects activities as of January 1, 1970, and is the fourth edition of the 'Water Quality Index', the first of which was the 1966 edition. Included in this index are (1) identification and location of stations, (2) major types of data collected, (3) frequency of data collection, (4) in what form the data are stored, and (5) agencies reporting the activities. (Woodard-USGS)
W71-04150

CATALOG OF INFORMATION ON WATER DATA, EDITION 1970-INDEX TO SURFACE WATER SECTION.
Geological Survey, Washington, D.C. Office of Water Data Coordination.

Geological Survey Water Data Catalog, 1970. 677 p, 2 fig, 2 exhibits, 4 tab.

Descriptors: *Data collections, *Hydrologic data, *Surface waters, *Gaging stations, *Data storage and retrieval, Documentation, Networks, Streamflow, Discharge measurement, Stream gages, Flow measurement, Watersheds (Basins), Monitoring, Maps, Instrumentation, Libraries, Investigations.
Identifiers: *Catalog of Information on Water Data, Station drainage area.

An index is presented for use in retrieving water quality data from the Catalog of Information on Water Data, a record of activities in water data collection in the U.S. The Catalog is a file of information that is accessible through data-retrieval procedures--it contains information about water data acquisition activities but does not contain the actual data, which must be obtained from the reporting agencies. Input to the Catalog consists of information supplied by Federal, State, and local agencies that acquire water data directly in the field and laboratory. All information is stored on media suitable for data processing, supplemented by microforms and maps. Information from the Catalog (output) is made available through indexes such as this publication which is the index to the surface water section of the Catalog. This index reflects activities as of January 1, 1970, and is the fourth edition of the 'Surface Water Index,' the first of which was the 1966 edition. Included in the index are (1) identification and location of stations, (2) major types of data collected, (3) frequency of data collection, (4) in what form the data are stored, and (5) agencies storing the data. (Woodard-USGS)
W71-04151

CALCULATION OF FLOOD WAVES FOR A LARGE RIVER SYSTEM,
Gidrometeorologicheskii Nauchno-Issledovatelskii Tsentr, Moscow (USSR).
For primary bibliographic entry see Field 02E.
W71-04176

METHODS OF SNOWMELT MAXIMUM DISCHARGE COMPUTATION IN CASES OF ABSENCE OR INSUFFICIENCY OF HYDROMETRIC DATA,
State Hydrological Inst., Leningrad (USSR).
For primary bibliographic entry see Field 02C.
W71-04177

HYDROGRAPH SYNTHESIS FOR WATERSHED SUBZONES FROM MEASURED URBAN PARAMETERS,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 04C.
W71-04184

FWPCA METHOD STUDY 1: MINERAL AND PHYSICAL ANALYSES - AN EVALUATION OF FWPCA ANALYTICAL METHODS FOR SURFACE WATERS,
Federal Water Pollution Control Administration, Cincinnati, Ohio. Analytical Quality Control Lab.
For primary bibliographic entry see Field 05A.
W71-04200

A GUIDE TO THE COMMON DIATOMS AT WATER POLLUTION SURVEILLANCE SYSTEM STATIONS,
Federal Water Pollution Control Administration, Cincinnati, Ohio. Div. of Pollution Surveillance.
Cornelius I. Weber.
Available from: EPA WQO, Analytical Quality Control Laboratory, 1014 Broadway, Cincinnati, Ohio 45202. June 1966. 101 p, 164 fig.

Descriptors: *Diatoms, *Bioindicators, *Plankton, Colorado River, Columbia River, Delaware River, Hudson River, Mississippi River, Missouri River, Ohio River, Rio Grande, St. Lawrence River, Tennessee River, Great Lakes.
Identifiers: Sorting, Identification, Animas River, Apalachicola River, Arkansas River, Illinois River, Kanawha River, Klamath River, Little Miami River, Potomac River, Red River, Savannah River, Schuylkill River, Snake River, Yellowstone River.

A total of 164 diatom species are described and illustrated, representing 43 of the common genera found at FWPCA Water Pollution Surveillance System stations. Some of the species were selected primarily to demonstrate the morphological diversity within the genera. The geographical distribution of 96 of the species is shown in an accompanying chart. This guide was prepared to serve as a bench reference for biologists in the laboratory who are being trained in diatom identification. The guide also contains a glossary and generic key. The key was constructed with the beginner in mind, and is based entirely on the shape and markings of the diatom cell wall as observed in material mounted in Hyrax. No attempt was made to place the taxa in their proper phylogenetic order. (McCann-Battelle)
W71-04210

SPATIAL PATTERNS OF SOCIO-ECONOMIC STRUCTURE IN INDIA,
Iowa Univ., Iowa City. Inst. of Urban and Rural Research; Iowa Univ., Iowa City. Dept. of Geography; and Northern Illinois Univ., De Kalb. Dept. of Geography.
For primary bibliographic entry see Field 06B.
W71-04234

A NEW APPROACH TO THE CLASSIFICATION OF CLIMATE,
Middlebury Coll., Vt. Dept. of Geography.
For primary bibliographic entry see Field 02B.
W71-04235

VERIFYING RECORDING PRECIPITATION GAUGE RECORDS,
Forest Service (USDA), Ogden, Utah. Intermountain Forest and Range Experiment Station.
Norbert V. DeByle, and Harold F. Haupt.
Journal of Soil and Water Conservation Vol 24, No 5, p 196-197, September-October 1969.

Descriptors: *Rain gages, *Precipitation gages, *Precipitation intensity, *Rainfall intensity, *Precipitation (Atmospheric), Gages, Instrumentation, Measurement, Utah.

Accurate precipitation records can be obtained from a weighing-type recording precipitation gage if the amount of liquid in the bucket is measured with a graduated cylinder to verify the final reading on the chart. For an 8-inch-diameter orifice gage, the catch in milliliters is multiplied by 0.001214 to convert it to inches precipitation. (DeByle-Forest Service)
W71-04264

USING COMPUTERS TO HELP EVALUATE FLOOD PROTECTION MEASURES,
Economic Research Service, Washington, D.C. Natural Resource Economics Div.; and Oklahoma State Univ. Stillwater. Dept. of Agricultural Economics.
Ronald D. Lacewell, and Vernon R. Eidman.
Oklahoma State University Agricultural Research, Oklahoma Current Farm Economics, December 1969, Vol 42, No 4, p 5-11. 1 tab, 6 ref.

Descriptors: *Evaluation, *Computer models, *Computer programs, *Flood protection, *Water conservation, Resource allocation, Benefits, Flood routing, Productivity, Land use, Flood plains, Planning, Estimating, Flood damage, Water management (Applied), Net income, Oklahoma, Damages, Data collections, Return (Monetary).
Identifiers: *Nuyaka Creek flood plain (Oklahoma), Inundation depth, Flood ranges, Occurrence probability.

A computer program for estimating flood damage incidence was developed to assist flood protection planning agencies and flood plain farmers. The model estimates damages for land use, productivity, inundation depth and location. Larger area damages are summations of these individual categories. The model computes damages by grids of sample sites and assigned possible flood ranges. Average annual damages are estimated by weighting damages for each storm by its occurrence probability. The model was tested by application to Nuyaka Creek flood plain, east-central Oklahoma. Care must be exercised in the method of measuring benefits to flood protection and land use adjustments. Flood protection benefits are the difference between net returns for present land use and no protection ($11,700), and net returns for optimum land use with protection ($107,200). The difference between net returns with and without flood protection for present land use ($6,700) is an estimate of minimum expected flood protection benefits. A table shows present and optimum flood plain land use pattern and associated dollar values with and without flood protection at Nuyaka Creek. (Popkin-Arizona)
W71-04293

08. ENGINEERING WORKS

8A. Structures

WATER, A PROGRESS REPORT.
California State Dept. of Water Resources, Sacramento.

Department of Water Resources, Bulletin No 151-67, September 1968. 32 p, 28 fig.

Descriptors: *Water transfer, *Aqueducts, *Water supply, *Water resources development, *Water conveyance, *Construction, Powerplants, Pumping plants, Hydrologic data, Seismic studies, Earthquake engineering, Multiple-purpose reservoirs, *California.

Progress is summarized in the construction of the State Water Project, the world's largest single water development project. It is designed to conserve and deliver 4.23 million acre-feet of water annually to meet demands throughout much of California until 1990. Much of the project planning is being implemented by local agencies. Capital costs are estimated to exceed $2.8 billion. Project customers will repay about 90 percent of the total capital costs. The federal government will pay 3 percent, and the state the remaining 7 percent. California customers will buy water from the State Water Project and will contract for the use of the proposed San Joaquin Master Drain to remove excessively saline agricultural wastes from the endangered lands of the San Joaquin Valley. Water will be supplied from lakes formed by five dams on the Feather River and its tributaries northeast of San Francisco. The regulated release of water from Lake Oroville will flow down the Feather and

Sacramento Rivers and into the Sacramento-San Joaquin Delta. A part of the flow will enter San Francisco Bay and the balance will be conducted by a Peripheral Canal and aqueducts to supply water to south bay areas, and community and agricultural users along the Central Valley, and as far south as Riverside. Power generation is also a feature of the Project. Descriptions are given of hydrologic and geologic data collection activities, and snow runoff and earthquake prediction. Design considerations and recreational facilities are described. Design features and operational methods are highlighted and construction progress is summarized. Completion is scheduled for 1972. (Poertner)
W71-03905

1939 RUNOFF INSTRUCTIONS FOR DESIGN OF STORM DRAINS, OFFICE STANDARD NO. 71.
Los Angeles Bureau of Engineering, Calif.

Office Standard No 71, 1966. 51 p, 23 fig, 8 tab.

Descriptors: *Drainage engineering, *Drainage practices, *Storm drains, *Storm runoff, *Design standards, Hydrology, Hydraulics, Urbanization, Rainfall-runoff relationships, Runoff forecasting, Surface runoff, Drainage systems, Conduits, California.
Identifiers: *Storm sewers, *Urban drainage, Los Angeles (Calif).

The publication is an assembly of tables, curves, and instructions for computation of urban storm runoff and for designing urban stormwater drains under various conditions of topography, imperviousness, soil types, slopes and precipitation intensities. The material was first printed in 1939 to serve as an office standard in the Storm Drain Design Division of the Bureau of Engineering. This printing contains revisions to previous printings and adds several new parts including: a section titled 'Hydrology of Steep Hillside or Mountainous Areas in Natural State', a formula for computing the adjusted time of concentration at junctions of a main-line storm drain with its laterals, and other charts and tables. The design instructions for computing runoff are based upon theories and methods outlined in two papers: (1) 'A Method of Computing Urban Runoff,' by W. I. Hicks (Transactions, American Society of Civil Engineers, Vol. 109, March 1945); and (2) 'Surface Runoff Determinations from Rainfall without Using Coefficients,' by W. W. Horner and S. W. Jens (Transactions, ASCE, Vol. 107 (1942), page 1039). Detailed instructions are given for applying the 'peak rate' method and the method of 'summing hydrographs' for computing runoff. Reduction factors to account for conduit detention in computing peak runoff flows are given. (Poertner)
W71-03906

STRESS DISTRIBUTION INSIDE HOMOGENEOUS ROCK-TALUS DAMS,
Bureau of Reclamation, Denver, Colo.
N. A. Andryanova.
Translation of: Gidrotekhnicheskoe Stroitel'stvo, No 10, p 25-28, 1965. Available from NTIS as PB-193 647, $3.00 in paper copy, $0.95 in microfiche. Bureau of Reclamation Translation No 625. Aug 1966. 15 p, 6 fig, 3 ref.
Identifiers: *Dams, Stresses, Rock (Geology), Pressure, Mathematical analysis, Foundations (Structures), USSR, Translations, Rockfill dams.

The basic propositions are presented of the method of Professor Ode * (Wasserwisischaft u. Wassertechnik, Vol 3, No 7:248-252, 1953) for the computatiõn of the stresses within the body of a homogeneous earthen dam, however with the difference that the transverse pressure coefficient of the soil is determined not by the trial and error method as in the case of Ode, but on the basis of the theory of soil pressure on a rigid wall with account for the computation coefficient following Prokof'yev. (Author)
W71-04003

MOLE DRAINAGE,
Arctic Construction and Frost Effects Lab., Boston, Mass.
Howard M. Williams, and James F. Haley.
Available from NTIS as AD-712 582, $3.00 in paper copy, $0.95 in microfiche. Technical Report No ACFEL-TR-38, Sept 1951. 36 p.
Identifiers: *Landing fields, Drainage, *Drainage, Structures, Soils, Plasticity, Earthhandling equipment, Pipes, Concrete, Mixtures, Asphalt, Cements, Grout, Sand, Stability, Pumps, Structural properties, Pavements, *Mole drainage, Portland cements.

A mole drainage system has proved very effective in reclaiming many areas of low-lying poorly drained agricultural lands and should prove a valuable tool in the construction of airfields under similar conditions. It is believed that even in soils containing some sand or silt, the mole drains would greatly increase drainage for short periods of time with resultant construction benefits. It is recognized that the mole drains would greatly increase drainage for short periods of time with resultant construction benefits. It was recognized that the mole drain's usefulness was severely limited unless some simple but effective method of making the drain a relatively stable structure in a wide variety of soil conditions could be achieved. It was to study this problem that a series of laboratory investigations and model tests were initiated in the Soils Laboratory of the New England Division, Corps of Engineers, in Boston in 1946. The investigations to date have followed two general paths of study: First, to attempt to strengthen the existing soil walls of the mole drain by a coating or liner cast in place during the passage of the mole plow and, second, to insert a suitable prefabricated liner into the mole drain behind the plow.
W71-04008

PRECAST REINFORCED CONCRETE IN HYDRAULIC CONSTRUCTION,
Bureau of Reclamation, Denver, Colo.
For primary bibliographic entry see Field 08F.
W71-04015

INFORMATION FOR APPLICANTS FOR CONSTRUCTION, ALTERATION, OR REPAIR OF DAMS.
For primary bibliographic entry see Field 06E.
W71-04094

8B. Hydraulics

INFLUENCE OF THE BANKS AND FLOOD PLAIN ON CHANNEL CONVEYANCE,
For primary bibliographic entry see Field 02E.
W71-03968

SEDIMENT TRANSPORT IN DEGRADING RIVERS,
California Univ., Berkeley. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02J.
W71-03995

BEDLOAD FORMULAS. PART A. A SELECTION OF BEDLOAD FORMULAS. PART B. PROGRAM LISTINGS FOR BEDLOAD FORMULAS,
Pennsylvania State Univ., University Park. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02E.
W71-03999

WATER MEASUREMENT PROCEDURES - IRRIGATION OPERATORS' WORKSHOP.
Bureau of Reclamation, Denver, Colo. Engineering and Research Center.

Available from NTIS as PB-195 275, $3.00 in paper copy, $0.95 in microfiche. Edited by J. C. Schuster. Bureau of Reclamation Report REC-OCE-70-38, September 1970. 49 p, 52 fig, 37 ref.

Descriptors: *Hydraulics, *Hydraulic structures, *Irrigation, Parshall flumes, *Discharge measurement, *Water measurement, Closed conduit flow, Discharge coefficients, Weirs, Orifices, Current meters, Bibliographies, Irrigation operation and maintenance, Venturi meters, Radioisotopes, Field investigations, Flowmeters, Instrumentation.
Identifiers: Irrigation Operators' Workshop, Dilution method, Magnetic flow meters, Ultrasonic flow measurement, Constant-head-orifice T O.

Water Measurement Procedures were written primarily for use in the Irrigation Operators' Workshop classes as a teaching aid in presenting the fundamentals of water measurement to field personnel engaged in irrigation work. Technical material has been simplified to provide a clear understanding of water measurement devices and procedures. Basic hydraulics presented include the discharge equation, velocity head concept, orifice and weir relationships, and the effect of submergence. Factors affecting the accuracy of measurement such as work equipment, infrequent head measurement, and use of wrong measuring devices are analyzed. Commonly used devices and methods are discussed, including orifices, weirs, Venturi meters, Parshall and Venturi flumes, meter gates, constant head turnouts, and propeller meters; special devices and methods include vane deflection meters, acoustic and magnetic meters, and the dilution and radioisotope methods of measurement. Hints for troubleshooting poorly operating devices, suggestions to operators on how to do a good job, and a selected reading list for operators are given. This edition supersedes the previous editions numbered Hyd 552, 565, and 577.
W71-04007

CHAIN MODEL OF RIVER MEANDERS,
Illinois Univ., Urbana. Dept. of Metallurgy and Mining Engineering.
For primary bibliographic entry see Field 02E.
W71-04124

THE UNIVERSALISATION OF THE CO-ORDINATES OF LOGARITHMIC WEIR PROFILES,
Indian Inst. of Science, Bangalore. Dept. of Civil and Hydraulic Engineering.
For primary bibliographic entry see Field 07B.
W71-04127

THE TRAPEZOIDAL FREE OVERFALL,
Alberta Univ., Edmonton. Dept. of Civil Engineering.
N. Rajaratnam, and D. Muralidhar.
Text also in French. Journal of Hydraulic Resarch, Vol 8, No 4, p 419-447, 1970. 29 p, 12 fig, 2 tab, 18 ref.

Descriptors: *Stage-discharge relations, *Open channel flow, *Overfalls, Open channels, Hydraulics, Discharge measurement, Stream gages, Flumes, Canals.
Identifiers: *Overfalls (Trapezoidal).

A theoretical and experimental study of trapezoidal free overfall predicts the end depth ratio for horizontal and sloping channels. The pressure coefficient at the end section was obtained from direct pressure measurements and it lies between the values for rectangular and triangular overfalls. Two charts were constructed to facilitate the prediction of discharge when the end depth is known. Supplementary information regarding the flow profile, velocity field and the bed shear stress are presented. (Knapp-USGS)
W71-04128

EXPERIMENTAL STUDIES ON LINEAR PROPORTIONAL WEIRS WITH TRIANGULAR BOTTOMS,
Indian Inst. of Science, Bangalore. Dept. of Civil and Hydraulic Engineering.
N. S. Lakshmana Rao, and G. Purushotham.
Journal of Hydraulic Research, Vol 8, No 4, p 449-455, 1970. 7 p, 8 fig, 1 tab, 1 ref.

Descriptors: *Calibrations, *Weirs, *Discharge measurement, *Stream gages, *Stage-discharge relations, Discharge (Water), Surface waters, Streamflow.
Identifiers: *Weirs (Triangular section).

Because triangular weirs are more sensitive than rectangular weirs, especially at low flows, the rectangular base-weir of the Sutro weir can be advantageously replaced by a triangular bottom. None symmetrical and three asymmetrical linear proportional weirs with triangular bottoms were tested for different values of height and width. A nomogram was prepared for finding the discharge coefficient. (Knapp-USGS)
W71-04129

8C. Hydraulic Machinery

DETERMINING THE CRITICAL SPEEDS OF HYDRAULIC UNIT SHAFTS,
Bureau of Reclamation, Denver, Colo.
L. L. Smelkov.
Translated from: Energomashinostroenie No 1, p 21-22, 1966. Available from NTIS as PB-193 634T, $3.00 in paper copy, $0.95 in microfiche. Bureau of Reclamation Translation No 714, March 1967. 8 p, 1 fig, 4 ref.

Descriptors: *Critical speed, Hydraulic turbines, Differential equations, Hydraulic machinery, Generators, *Vibrations, Torsion, Fluid flow, Design tools, *Shafts, Machinery, Electromagnetism, Foreign design practices, Mathematical analysis, Deflection, Natural frequency, Cantilevers, Stress, Moments of inertia, *Rotating components, Structural analysis.
Identifiers: USSR, Rotors, Machine design, Stators, Gyroscopic effects.

Effect of quasi-elastic forces of electromechanical origin on the primary critical speed of a shaft in calculating natural frequencies of torsional and transverse vibrations is shown. New methods introduced by USSR hydroturbine manufacturers for calculating shaft stability should consider the generator not only as a concentrated mass but also for the electromagnetic field it creates. This leads to new phenomena, especially in determining critical speeds for transverse vibrations. An equivalent mechanical system with parameters depending on characteristics of generator windings and operating conditions can be substituted for the electromagnetic field in determining natural frequencies of torsional vibrations. Solving the differential equations shows that electromechanical vibration frequency is from 0.5-2.5 cps, indicating that calculation of these values is obligatory to construct a full frequency spectrum. For transverse vibrations, a 1-sided electromagnetic pull between the rotor and stator and forces of inertia on the deflection of the shaft must be considered. The author concludes that calculating the electromagnetic field for torsional vibrations gives a smaller value for natural vibration frequency and for transverse vibrations leads to a lowering of the primary critical speed. Sample calculations for a specific shaft are given.
W71-03996

EXPERIMENTAL INVESTIGATIONS OF HYDRAULIC TURBINES WITH COMBINED RUNNERS,
Bureau of Reclamation, Denver, Colo.
L. P. Gryanko, and V. G. Staritskii.
Translated from: Trudy Leningradskogo polytekhnicheskogo instituta No 297, p 63-67, 1968. Available from NTIS as PB-193 643T, $3.00 in paper copy, $0.95 in microfiche. Bureau of Reclamation Translation No 579, Aug 1969. 12 p, 6 fig, 5 ref.

Descriptors: *Hydraulic machinery, *Hydraulic turbines, Foreign design practices, Model tests, *Turbine runners, Laboratory tests, Efficiencies, Cavitation, Research and development, Mechanical engineering, Hydraulics, Surges, Turbulent flow, Testing machines, Discharge measurement, Hydraulic design, Foreign research.
Identifiers: USSR, Leningrad Polytechnic Inst, Krasnoiarsk Powerplant, *Machine design, Comparative studies.

The Hydraulic Machinery Laboratory at Leningrad Polytechnic Institute has developed a combined Francis and propeller runner to fit the operating conditions and dimensions of Krasnoiarsk Hydropowerplant. Models of 2 alternative designs of this runner were tested and the data compared with that of Runner RO-697, the Francis runner used at Krasnoiarsk. The only dimensional design change is that the flare angle of the lower band is 13 deg instead of the 20 deg of RO-697. The model tests and data analysis led to these conclusions: (1) Since specific speed and discharge capacity of the combined runner are significantly higher than for RO-697, using this runner at Krasnoiarsk would increase unit capacity at the generator to 580 mw and reduce the total number of units by one. (2) Energy factors for the improved model design showed that efficiency was only 0.5 or 1% less than that of RO-697. (3) Cavitational qualities were about equal. (4) Pressure surges beyond the new runner were 30-40% lower than beyond RO-697, reducing turbulence in design operating conditions and also during startup at reduced heads. The combined runner's greater discharge capacity will increase its operational reliability over that of RO-697.
W71-03998

SARATOV HYDROELECTRIC POWERPLANT CONSTRUCTION DATA,
Bureau of Reclamation, Denver, Colo.
L. I. Kudoyarov, and N. P. Borodin.
Translated from: Gidrotekhnicheskoe Stroitel'stvo No 4, p 4-10, 1966. Available from NTIS as PB-193 629T, $3.00 in paper copy, $0.95 in microfiche. Bureau of Reclamation Translation No 703, Aug 1967. 24 p, 6 fig.

Descriptors: Hydroelectric powerplants, Kaplan turbines, Foreign projects, Precast concrete, Reinforced concrete, Reinforcing, *Forms, Concrete, *Concrete technology, Concrete structures, Concrete plants, Aggregates, Erection, Earth handling equipment, Excavation, Foundations, Joints, Dams, Aprons, Earth dams, Dikes, *Hydraulic fills, Multiple purpose structures, Locks, Slope protection, Fish handling facilities, Construction, Hoisting machinery, Manufacturing.
Identifiers: USSR, Hydromechanization, Saratov Powerplant (USSR), Volga Cascade System (USSR), Run-of-the-river powerplant.

Saratov hydrocomplex, the seventh step of the Volga cascade to be constructed in the USSR, is unique among low-head, run-of-the-river powerplants, because it is largely constructed of huge precast, reinforced concrete elements made monolithic by careful grouting of the joints and overlap welding of protruding reinforcement rods. Among the basic features described are: the common structure containing 21 vertical and 2 horizontal units for passing surplus river discharges and generating power; fish-handling facilities; two-level railroad and highway bridge; and the double single-stage dry-dock-type ship locks. Interesting features include the 3-level powerhouse arrangement with turbine bypass spillways equipped with louvered fish inlets; the earthfill dam and dikes with interlocking concrete slab slope protection; and the upstream apron constructed of 10-m-thick hydromechanized fill sandwiched between concrete slabs. The production line for precast reinforced concrete elements weighing up to 200 tons each and erection methods developed to handle such loads are described. This includes the crane-operated tilter for uprighting slabs manufactured in a horizontal position. Production methods for forming, automatic welding of reinforcement frames, pouring and vibrating, and steam-curing are given.
W71-04017

8D. Soil Mechanics

DETERMINATION OF SOIL PERMEABILITY BY THE METHOD OF LARGE RINGS,
Bureau of Reclamation, Denver, Colo.
For primary bibliographic entry see Field 02G.
W71-04006

DRAINAGE LINE DEPTH,
Bureau of Reclamation, Denver, Colo.
I. M. Krivonosov.
Translated from: Gidrotekhnika i Melioratsiya Vol 18, No 6, p 44-51, 1966. Available from NTIS as PB-193 617T, $3.00 in paper copy, $0.95 in microfiche. Bureau of Reclamation Translation No 685, Oct 1967. 11 p, 5 fig, 1 tab, 11 ref.
Identifiers: *Soils, Drainage, Permeability, Clay, Sand, Penetration, Cracks, Water, Fluid flow, Freezing, Melting, Reclamation, Terrain, USSR, Translations, Land reclamation.

The principal factors determining the selection of drainage line depth are: the filtering capacity of the soils, the depth to which the soil freezes and the course of its thawing, the purpose for which the land is being reclaimed, and the critical calculated period for removal of ground waters. Under similar soil conditions but with different freezing depth, the rational solutions of this problem may differ. For water-permeable noncoherent soil conditions the relationship between the depth of the drains and the distance between them is sufficiently well established, and among the specialists no differences of opinion exist on the problem of the optimum drain depth. However, there are different opinions on the depth at which a drain should be placed in clayey soils and ground. The question of the necessary depth for drains in clayey loam and clayey soil-ground is examined.
W71-04016

8E. Rock Mechanics and Geology

STRESS DISTRIBUTION INSIDE HOMOGENEOUS ROCK-TALUS DAMS,
Bureau of Reclamation, Denver, Colo.
For primary bibliographic entry see Field 08A.
W71-04003

8F. Concrete

HOT-THERMOS METHOD OF CONCRETING,
Bureau of Reclamation, Denver, Colo.
Ya Besser.
Translated from: Stroitel' No 10, p 11-12, 1968. Available from NTIS as PB-193 640T, $3.00 in paper copy, $0.95 in microfiche. Bureau of Reclamation Translation No 533, March 1969. 6 p.
Identifiers: *Concrete, Processing, Heating elements, Experimental design, Electrical equipment, Safety, Sodium chloride, USSR, Translations.

A new method is described of winter concreting of monolithic structures, called the 'Hot Thermos Method', in which the concrete mix, prepared from cold ingredients, is delivered to the concreting site and electrically heated just before placement in the forms.
W71-03997

CONCRETE FOR KRANSNOLARSK DAM,
Bureau of Reclamation, Denver, Colo.

Ts. G. Ginzburg, N. A. Zinchenko, and G. F. Skvortsova.
Translated from: Gidrotekhnicheskoe Stroitel'stvo No 2, p 6-12, 1966. Available from NTIS as PB-193 611T, $3.00 in paper copy, $0.95 in microfiche. Bureau of Reclamation Translation No 676, Oct 1966. 31 p, 10 fig, 1 tab.

Descriptors: *Mass concrete, Concrete technology, Batching, *Concrete control, *Concrete mixes, Concrete placing, *Concrete plants, Concrete structures, *Concrete dams, Dosage, Measurement, Aggregates, Gradation, Field permeability tests, Conveyors, Automatic, Frost action, Quality control, Design standards, Portland cement, Slags, Foreign projects, Slump, Water cement ratio, Mechanization, Sands, Permeability, Cooling, Heating, Concrete testing, Cold weather operations.
Identifiers: USSR, Frost resistance, Krasnoiarsk Dam (USSR), Crack control.

Quality control field testing of aggregate, cement, and concrete at Krasnoiarsk Dam, USSR, showed, as of Sept 1964, that: (1) washed sands and gravel met specifications, except for larger fractions where a second sorting at the concrete plant was recommended; (2) cement was very satisfactory as to mineral composition, heat outflow, and strength; (3) both concrete control specimens and cores drilled from the mass concrete of the dam columns were within specification limits for strength and water impermeability; and (4) temperature control for concrete at placement was still not acceptable for summertime. However, in the 2 yrs since the first mass concrete placement (8-61), many problems had to be faced and many changes made in procedures, equipment, and organization in the aggregate processing plants, the Krasnoiarsk Cement Plant, and the 2 mixing plants to achieve the desired results. A fully automated continuous-flow concrete mix plant for both portland cement and slag-portland cement concretes and a 3-section batching plant for special types or batches of concrete are in use. The article discusses problems in the automated equipment, temperature control, supply, and construction site organization that had to be resolved. The figures show layout for continuous-flow mix plant, zoning of dam for types of concretes, cement chemical composition, and test results.
W71-04004

PRECAST REINFORCED CONCRETE IN HYDRAULIC CONSTRUCTION,
Bureau of Reclamation, Denver, Colo.
I. S. Zavalishin, and Yu. E. Chumichev.
Translated from: Gidrotekhnicheskoe Stroitel'stvo No 4, p 1-4, 1966. Available from NTIS as PB-193 628T, $3.00 in paper copy, $0.95 in microfiche. Bureau of Reclamation Translation No 702, Feb 1968. 20 p, 11 ref.

Descriptors: *Precast concrete, *Concrete technology, Foreign design practices, Foreign construction, Construction costs, Concrete structures, Joints, Joint fillers, Hydraulic structures, Concrete plants, Cast-in-place structures, Foundations, Girders, Floors, Panels, Piers, Erection, Reinforcing, Reinforced concrete, Slabs, Hydroelectric powerplants, *Construction joints, Hoisting machinery, Installation, Industrial plants, Transportation.
Identifiers: USSR, Kiev Powerplant (USSR), Precast concrete components, Innovation, Construction equipment, Evaluation, Saratov Powerplant (USSR).

The USSR is evaluating the technical effectiveness and economy of using precast reinforced concrete structural components to erect large hydraulic structures, such as the experimental powerplants of Kiev on the Dneiper and Saratov on the Volga. The primary conclusion drawn was that the use of this method must be evaluated separately for each project in relation to local conditions and design criteria. To effect actual economics, designers can standardize the recurring components of separate parts of powerplants, such as enclosures for spiral cases and draft tubes; embedded structural slots, keys, drains, etc.; inspection and drainage galleries; and reinforced panels for run-of-the-river powerplants with not over 50 m of head. Only for run-of-the-river plants with heads less than 20 m can the exclusive use of these components in a structure be justified technically and economically. Manufacturing costs can be reduced to 40-45 rubles cu m to effect in-place costs of 50-60 r/cu m. Ideal use is building a series of 20 such plants in sequence of 2-3 at a time, served by the same mobile production-line manufacturing plant and construction equipment. Forming joints between the components, a major problem, has now been satisfactorily resolved.
W71-04015

09. MANPOWER, GRANTS AND FACILITIES

9A. Education (Extramural)

ANNUAL REPORT, JULY 1, 1969-JUNE 30, 1970,
North Carolina Water Resources Research Inst., Raleigh.
David H. Howells.
Available from NTIS as PB-197 120, $3.00 in paper copy, $0.95 in microfiche. Report UNC-WRRI-71-00, (1970). 49 p. 7 tab, 19 fig. OWRR Program A-999-NC (21).

Descriptors: Education, Colleges, Universities, Training, North Carolina, Allotments, Projects, Grants, Contracts, Programs, Research and Development.

The Institute's research program for fiscal year 1969-70 was supported by the annual allotment and seven matching grants from the Office of Water Resources Research, U.S. Department of the Interior, non-federal matching and other funds from the State of North Carolina and private industry, and one grant from the Z. Smith Reynolds Foundation. The total value of the program in 1970 exceeded one-half million dollars--a five-fold increase since the first full year in 1966. This included twenty-three research projects and other activities involving thirty-two man-years of graduate students, faculty and staff. This report contains description of water resource problems and related research projects, summary of research findings, and discussion of program development, education, and public service programs.
W71-03921

FEDERAL WATER RESOURCES RESEARCH ACTIVITIES.
Federal Council for Science and Technology, Washington, D.C.
For primary bibliographic entry see Field 06E.
W71-04105

9D. Grants, Contracts, and Research Act Allotments

ANNUAL REPORT, JULY 1, 1969-JUNE 30, 1970,
North Carolina Water Resources Research Inst., Raleigh.
For primary bibliographic entry see Field 09A.
W71-03921

BUREAU OF RECLAMATION APPROPRIATION ACTS AND ALLOTMENTS: 1966 STATISTICAL SUPPLEMENT.
Bureau of Reclamation, Denver, Colo.

1968. 579 P, 2 INDEXES, 471 TAB.

Descriptors: *Federal reclamation law, *Statistics, *Allotments, *Data collections, Financing, Administrative agencies, Administration, Government finance, Grants, Legislation, Cost allocation, Loans, Reclamation, Missouri River Basin, Federal budgets, Federal government, United States, Federal jurisdiction, Assessments, Legal aspects, Water resources development, Economics, Loans.

Generally, this statistical supplement provides detailed information relating to the funding of those various water resource projects over which the Bureau of Reclamation has some degree of responsibility. Presented is a tabulation of appropriation acts and allotments to 471 Bureau of Reclamation projects and activities. Chapter one and two deal with those public and private appropriation acts passed for the Bureau of Reclamation by the 87th through the 90th Congresses. The balance of the report contains statistical tables regarding appropriations and allotments in fiscal years 1903 through 1966. The report excludes funding activity relating to: (1) appropriation transfers to other governmental agencies or projects, and (2) unused appropriations. Chapter four contains detailed tables regarding 176 specific projects or activities funded through the Bureau of Reclamation. Allotments made to 145 activities and projects within the Missouri River Basin are listed in Chapter five. Chapter six presents statistics on Bureau of Reclamation loan programs. Project allocations from emergency relief appropriations are set forth in Chapter seven, and water conservation and utility project allotments are presented in Chapter eight. (Earl-Florida)
W71-04103

FEDERAL WATER RESOURCES RESEARCH ACTIVITIES.
Federal Council for Science and Technology, Washington, D.C.
For primary bibliographic entry see Field 06E.
W71-04105

BUREAU OF RECLAMATION APPROPRIATION ACTS AND ALLOTMENTS.
Bureau of Reclamation, Washington, D.C.

U. S. Government Printing Office, Washington, D.C. 1001 p.

Descriptors: *Allotments, *Land reclamation, *Federal Reclamation Law, *Legislation, Federal government, Statistics, Reclamation, Administrative decisions, Budgeting, Financing, Capital, Capital supply, Legal aspects, Reclamation states, Flood control, Construction costs, Soil conservation, River basin development, Levees, Dam construction, Hydroelectric plants, Water utilization.

A chronoloigcal compilation of allotments and appropriations for the Bureau of Reclamation during the period 1903-1960, this publication lists: (1) allotments authorized by the Secretary of the Interior, (2) appropriation acts of Congress, (3) private laws dealing with reclamation, (4) contingency funds allotted, (5) flood control appropriations made to the War Department, (6) soil and moisture conservation allotments, (7) emergency relief appropriations, (8) civiliam public service camp and conservation corps allotments, and (9) interagency transfers of appropriations. Within the text of the various appropriations and allotments, frequent mention is made of specific levee systems, river development, river-basin development, hydroelectric power projects, dam projects, and other water-related projects within the purview of the Bureau of Reclamation. A listing of water-conservation-and-utilization project funds transferred to other governmental agencies is also presented. (Earl-Florida)
W71-04309

10. SCIENTIFIC AND TECHNICAL INFORMATION

A REVIEW OF THE 1969 LITERATURE ON WASTE WATER AND WATER POLLUTION

CONTROL, ADMINISTRATION: SYSTEMS ANALYSIS,
Cornell Univ., Ithaca, N.Y.
For primary bibliographic entry see Field 05G.
W71-03879

WATER RESOURCES SYSTEMS ENGINEERING,
California Univ., Riverside. Dept. of Engineering; and California Univ., Los Angeles. Dept. of Engineering.
For primary bibliographic entry see Field 06A.
W71-03885

ENGINEERING EVALUATION OF FACTORS AFFECTING QUALITY OF WATER SOURCES AVAILABLE FOR SALINE WATER CONVERSION PLANTS,
Powell (Sheppard T.) and Associates, Baltimore, Md.
For primary bibliographic entry see Field 03A.
W71-03916

LITERATURE SURVEY OF MOISTURE MIGRATION IN SOILS DUE TO THERMAL GRADIENTS,
Northwestern Univ., Evanston, Ill. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02C.
W71-04000

GLOSSARY OF TERMS USED IN WELL LOGGING,
Chevron Oil Co., Houston, Tex.
Robert E. Sheriff.
Geophysics, Vol 35, No 6, p 1116-1139, December 1970. 24 p, 15 fig.

Descriptors: *Publications, *Logging (Recording), *Wells, Documentation, Technical writing, Electrical well logging, Radioactive well logging, Boreholde geophysics, Seismic studies.
Identifiers: *Well logging terms (Glossary).

This glossary of terms used in well logging is presented as a semifinal draft of a part of a larger glossary of terms used in geophysical exploration. (Knapp-USGS)
W71-04113

REVERSE OSMOSIS DESALTING STATE-OF-THE-ART (1969).
Hittman Associates, Inc., Columbia, Md.
For primary bibliographic entry see Field 03A.
W71-04225

ABSTRACTS OF LITERATURE ON THE DISTILLATION OF SEAWATER AND ON THE USE OF NUCLEAR ENERGY FOR DESALTING.
Oak Ridge National Lab., Tenn.
For primary bibliographic entry see Field 03A.
W71-04226

SUBJECT INDEX

ABLATION
PROBLEM OF THE CLASSIFICATION AND SPATIAL VARIABILITY OF THE ALBEDO OF A HOMOGENEOUS GLACIER SURFACE DURING THE ABLATION PERIOD,
W71-03971 02C

ABSORPTION
DESIGN OF ACTIVATED CARBON ADSORPTION BEDS,
W71-03897 05D

ABSTRACTS
ABSTRACTS OF LITERATURE ON THE DISTILLATION OF SEAWATER AND ON THE USE OF NUCLEAR ENERGY FOR DESALTING.
W71-04226 03A

ACCLIMATIZATION
RESPONSES OF NATIVE AND MIGRANT DESERT RESIDENTS TO ARID HEAT,
W71-04301 02I

ACCRETION(LEGAL ASPECTS)
WYKLE V COLOMBO (APPORTIONMENT OF ACCRETIONS BETWEEN ADJACENT RIPARIAN OWNERS).
W71-04078 06E

BAUMHART V MCCLURE (OWNERSHIP OF RIPARIAN LAND AFTER SUSTAINED SUBMERGENCE).
W71-04330 06E

MEEKER V KAUTZ (TITLE TO ISLANDS IN NAVIGABLE RIVER).
W71-04331 06E

ACID MINE WATER
THE INCIDENCE AND FORMATION OF MINE DRAINAGE POLLUTION - APPENDIX C TO 'REPORT FOR DEVELOPMENT OF WATER RESOURCES OF APPALACHIA'.
W71-03872 05B

STREAM POLLUTION BY COAL MINE DRAINAGE IN APPALACHIA.
W71-03873 05B

A REVIEW OF CURRENT RESEARCH ON COAL MINE DRAINAGE IN APPALACHIA,
W71-03874 05B

FACTORS THAT AFFECT THE FORMATION OF COAL MINE DRAINAGE POLLUTION IN APPALACHIA,
W71-03875 05B

THE OXIDATION OF PYRITE ASSOCIATED WITH COAL MINES,
W71-03876 05B

SURVEY OF COSTS ON METHODS FOR CONTROL OF ACID MINE DRAINAGE POLLUTION,
W71-03877 05B

MINE ACID DRAINAGE AND ASSOCIATED FLOW FLUCTUATIONS,
W71-03938 05B

THE EVALUATION OF ENVIRONMENTAL ALTERATION BY THERMAL LOADING AND ACID POLLUTION IN THE COOLING RESERVOIR OF A STEAM-ELECTRIC STATION,
W71-04019 05C

FEASIBILITY STUDY OF MINING COAL IN AN OXYGEN FREE ATMOSPHERE.
W71-04187 05G

TREATMENT OF ACID MINE DRAINAGE BY FOAM SEPARATION,
W71-04188 05D

NEUTRALIZATION OF HIGH FERRIC IRON ACID MINE DRAINAGE,
W71-04189 05D

ACTIVATED CARBON
DESIGN OF ACTIVATED CARBON ADSORPTION BEDS,
W71-03897 05D

ACTIVATED SLUDGE
CHEMICAL PRECIPITATION OF PHOSPHATE WITHIN A HIGH RATE BIO OXIDATION SYSTEM I. SYNTHETIC SEWAGE STUDIES,
W71-03900 05D

ENGINEERING ASPECTS OF SURFACE AERATION DESIGN,
W71-04073 05D

SOLIDS SEPARATION BY ULTRAFILTRATION FOR CONCENTRATED ACTIVATED SLUDGE,
W71-04087 05D

METABOLIC RESPONSE OF ACTIVATED SLUDGE TO SODIUM PENTACHLOROPHENOL,
W71-04088 05D

ACTIVITY COEFFICIENTS(ELECTROLYTES)
THEORETICAL MEAN ACTIVITY COEFFICIENTS OF STRONG ELECTROLYTES IN AQUEOUS SOLUTIONS FROM 0 TO 100 DEG C,
W71-04183 01B

ADAPTABILITY
ECOLOGICAL SIGNIFICANCE OF ALIEN PLANTS IN CALIFORNIA GRASSLANDS,
W71-04233 04A

PERENNATION IN ASTRAGALUS LENTIGINOSUS AND TRIDENS PULCHELLUS IN RELATION TO RAINFALL,
W71-04299 02I

RESPONSES OF NATIVE AND MIGRANT DESERT RESIDENTS TO ARID HEAT,
W71-04301 02I

ADAPTIVITY
ROOTSTOCKS FOR VALENCIA ORANGES AND LIBSON LEMONS IN ARIZONA,
W71-04059 03F

ADJUDICATION PROCEDURE
WYKLE V COLOMBO (APPORTIONMENT OF ACCRETIONS BETWEEN ADJACENT RIPARIAN OWNERS).
W71-04078 06E

ADMINISTRATION
INSTITUTIONAL DESIGN FOR WATER QUALITY MANAGEMENT THE IMPLICATIONS OF A SYSTEMS APPROACH FOR LEGAL AND ADMINISTRATIVE ARRANGEMENTS,
W71-03867 06E

WATER QUALITY CONTROL A MODERN APPROACH TO STATE REGULATION,
W71-04101 06E

PROCEEDINGS CONFERENCE ON POLLUTION OF LAKE MICHIGAN AND ITS TRIBUTARY BASIN, ILLINOIS, INDIANA, MICHIGAN, AND WISCONSIN.
W71-04256 05G

RULES OF PRACTICE AND PROCEDURE.
W71-04327 06E

ADMINISTRATIVE AGENCIES
NEW HORIZONS IN WATER RESOURCES ADMINISTRATION,
W71-03887 06E

KENTUCKY WATER RESOURCES 1965 (SUMMARY OF INFORMATION INVOLVING KENTUCKY'S WATER RESOURCES).
W71-04021 06E

REORGANIZATION PLANS NOS. 3 AND 4 OF 1970.
W71-04326 06E

ADMINISTRATIVE DECISIONS
LITTLE FALLS FIBRE CO V HENRY FORD AND SON, INC (FLASHBOARDS REDUCING RIPARIAN OWNER'S POWER HEAD).
W71-04203 06E

RULES OF PRACTICE AND PROCEDURE.
W71-04327 06E

GARDEN CLUB OF VIRGINIA V VIRGINIA PUBLIC SERVICE CO (JURISDICTION OF CORPORATION COMMISSION TO GRANT PERMIT FOR DAM ON NON=NAVIGABLE RIVER).
W71-04343 06E

ADMINSTRATIVE AGENCIES
ACTIVITIES OF THE FEDERAL WATER POLLUTION CONTROL ADMINISTRATION--WATER QUALITY STANDARDS.
W71-04096 06E

REORGANIZATION PLAN NO. 3 OF 1970 (ENVIRONMENTAL PROTECTION AGENCY).
W71-04325 06E

ADSORPTION
ADSORPTION OF BORON BY FERROMAGNESIAN MINERALS AND MAGNESIUM HYDROXIDE,
W71-03939 02G

ADVENTITIOUS ROOTS
FORMATION OF PHYTOGENIC HILLOCKS II. ROOTING HABIT OF PLANTS FORMING PHYTOGENIC HILLOCKS,
W71-04295 02I

ADVERSE POSSESSION
IN RE ROMA (ABILITY OF UPLAND OWNER TO ACQUIRE TITLE TO SUBMERGED LANDS BY ADVERSE POSSESSION).
W71-04146 06E

PARKS V PENNSYLVANIA RR (TITLE TO LAND PREVIOUSLY FLOOD BY BACKWATER).
W71-04243 06E

AERATED LAGOONS
ENGINEERING ASPECTS OF SURFACE AERATION DESIGN,
W71-04073 05D

AERATION
ENGINEERING ASPECTS OF SURFACE AERATION DESIGN,
W71-04073 05D

AERODYNAMIC COMPONENTS
POTENTIAL EVAPOTRANSPIRATION AND THE WATER BALANCE IN WEST AFRICA AN ALTERNATIVE METHOD OF PENMAN,
W71-04063 02D

AFRICA
THE DEVELOPMENT OF EGGS OF THE RED LOCUST NOMADACRIS SEPTEMFASCIATA (SERV.), AND THE AFRICAN MIGRATORY LOCUST, LOCUSTA MIGRATORIA MIGRATORIODES (R. AND F.), AND ITS INTERRUPTION UNDER PARTICULAR CONDITIONS OF HUMIDITY,
W71-04297 03F

ENVIRONMENTAL CONTROL OF COLORATION IN AN ACRIDID, GASTRIMARGUS AFRICANUS (SAUSSURE),

W71-04302 03F

AFRICAN MIGRATORY LOCUST
THE DEVELOPMENT OF EGGS OF THE RED LOCUST NOMADACRIS SEPTEMFASCIATA (SERV.), AND THE AFRICAN MIGRATORY LOCUST, LOCUSTA MIGRATORIA MIGRATORIOIDES (R. AND F.), AND ITS INTERRUPTION UNDER PARTICULAR CONDITIONS OF HUMIDITY,
W71-04297 03F

AGGRADATION
SOME ASPECTS OF THE GEOMORPHOLOGY OF THE AIR MOUNTAINS, SOUTHERN SAHARA,
W71-04050 02G

AGRICULTURAL CHANGE
THE IMPACT OF AGRICULTURAL CHANGE ON A LOCAL ECONOMY IN THE GREAT PLAINS,
W71-04289 03F

AGRICULTURAL CHEMICALS
MOVEMENT OF AGRICULTURAL POLLUTANTS WITH GROUNDWATER,
W71-04121 05B

AGRICULTURAL DEVELOPMENT
IRRIGATION DEVELOPMENT IN TUNISIA,
W71-04232 03F

AGRICULTURAL MECHANIZATION
WATER AND CULTURE NEW DECISION RULES FOR OLD INSTITUTIONS,
W71-04296 06E

AGRICULTURAL POLLUTANTS
MOVEMENT OF AGRICULTURAL POLLUTANTS WITH GROUNDWATER,
W71-04121 05B

AGRICULTURE
WATER TABLE DECLINE AND RESULTANT AGRICULTURAL PATTERNS IN THE SALT RIVER VALLEY OF ARIZONA,
W71-04065 03F

AGROCLIMATOLOGY
FARMING, FOREST AND SAVANNA IN WESTERN NIGERIA,
W71-04054 03F

AGROMETEOROLOGY SURVEY OF THE HIGHLANDS OF EASTERN AFRICA,
W71-04062 02D

SOME ASPECTS OF DROUGHT CLIMATOLOGY OF THE DRY SUBHUMID ZONES OF SOUTH INDIA,
W71-04298 02B

AIR MOUNTAINS
SOME ASPECTS OF THE GEOMORPHOLOGY OF THE AIR MOUNTAINS, SOUTHERN SAHARA,
W71-04050 02G

AIR TEMPERATURE
ELEVATION AND TEMPERATURE EFFECTS ON SEVERITY OF MAIZE DWARF MOSAIC VIRUS IN SORGHUM,
W71-04060 03F

ALBEDO
PROBLEM OF THE CLASSIFICATION AND SPATIAL VARIABILITY OF THE ALBEDO OF A HOMOGENEOUS GLACIER SURFACE DURING THE ABLATION PERIOD,
W71-03971 02C

ALGAE
DESIGN CONSTRUCTION AND MAINTENANCE OF WASTE STABILIZATION LAGOONS,
W71-03896 05D

MOVEMENT OF ALGAL- AND FUNGAL-BOUND RADIOSTRONTUM AS CHELATE COMPLEXES IN A CALCAREOUS SOIL,
W71-04067 05B

BIODEGRADABILITY OF POTENTIAL ORGANIC SUBSTITUTES FOR PHOSPHATES,
W71-04072 05D

RESPIRATORY RELATIONSHIPS OF A SYMBIOTIC ALGAL-BACTERIAL CULTURE FOR WASTE WATER NUTRIENT REMOVAL,
W71-04079 05D

ALGAL-BOUND RADIOSTRONTIUM
MOVEMENT OF ALGAL- AND FUNGAL-BOUND RADIOSTRONTUM AS CHELATE COMPLEXES IN A CALCAREOUS SOIL,
W71-04067 05B

ALGICIDES
THE PRESERVATION OF PHYTOPLANKTON GRAB SAMPLES,
W71-04207 05A

ALIEN PLANTS
ECOLOGICAL SIGNIFICANCE OF ALIEN PLANTS IN CALIFORNIA GRASSLANDS,
W71-04233 04A

ALKALINE WATER
PROTOTYPE STUDIES OF COMBINED TREATMENT OF WASTES FROM 22 TANNERIES AND TWO MUNICIPALITIES,
W71-03892 05D

ALKALINITY
ANAEROBIC DIGESTION FAILURES,
W71-03891 05D

ALLOTMENTS
BUREAU OF RECLAMATION APPROPRIATION ACTS AND ALLOTMENTS 1966 STATISTICAL SUPPLEMENT.
W71-04103 09D

BUREAU OF RECLAMATION APPROPRIATION ACTS AND ALLOTMENTS.
W71-04309 09D

ALLUVIAL CHANNELS
PATTERN OF VARIATION OF THE LENGTH OF FREELY MEANDERING RIVERS,
W71-03969 02J

ALLUVIUM
MINERALOGY OF SOME ARID AND SEMIARID LAND SOILS OF IRAQ,
W71-04061 02G

ALPS
DEUTERIUM MEASUREMENTS ON SNOW SAMPLES FROM THE ALPS,
W71-04136 02A

ALTERATION OF FLOW
LAND DEVELOPMENT, INC V LOUISVILLE GAS AND ELECTRIC CO (LIABILITY FOR FAULTY CONSTRUCTION OF CULVERT DIVERTING STREAM).
W71-04312 06E

WEST SHORE RR V STATE (LIABILITY FOR APPROPRIATION OF RIVER FLOW FOR NEW CHANNEL OUTSIDE RIVER).
W71-04321 06E

ALTITUDE
SOME CHARACTERISTICS OF THE THERMAL REGIME OF RIVERS IN THE DANUBE AND DNIESTER BASINS,
W71-03974 02K

DEUTERIUM MEASUREMENTS ON SNOW SAMPLES FROM THE ALPS,
W71-04136 02A

ALUMINUM
CHEMICAL EXFOLIATED VERMICULITE FOR REMOVAL OF PHOSPHATE FROM WASTE WATERS,
W71-04107 05D

AMALGAM ELECTRODES
THE USE OF AMALGAM ELECTRODES TO MEASURE ACTIVITY COEFFICIENTS IN MULTICOMPONENT SALT SOLUTIONS,
W71-04221 01B

AMMONIUM ALKALINITY
ANAEROBIC DIGESTION FAILURES,
W71-03891 05D

ANAEROBIC BACTERIA
THE ANAEROBIC FILTER FOR WASTE TREATMENT,
W71-04075 05D

ANAEROBIC CONDITIONS
THE ANAEROBIC FILTER FOR WASTE TREATMENT,
W71-04075 05D

ANAEROBIC DIGESTION
ANAEROBIC DIGESTION FAILURES,
W71-03891 05D

THE EFFECT OF SHORT-TERM TEMPERATURE VARIATIONS ON METHANE PRODUCTION,
W71-04077 05D

ANALOG MODELS
HYDROGRAPH SYNTHESIS FOR WATERSHED SUBZONES FROM MEASURED URBAN PARAMETERS,
W71-04184 04C

ANALYSIS PROBLEM
ARSENIC IN POTABLE DESERT GROUNDWATER AN ANALYSIS PROBLEM,
W71-04109 02K

ANALYTIC TECHNIQUES
RESOURCE SYSTEMS MODELS IN DECISION MAKING,
W71-03856 06A

INCORPORATING SOCIAL OBJECTIVES IN SYSTEMS MODELS,
W71-03862 06B

ANALYTICAL TECHNIQUE
A MULTI-PHASIC COMPONENT STUDY TO PREDICT STORM WATER POLLUTION FROM URBAN AREAS,
W71-03917 05C

ANALYTICAL TECHNIQUES
SPECTROPHOTOMETRIC DETERMINATION OF THIOCYANATE AND OXALATE,
W71-03928 05A

ARSENIC IN POTABLE DESERT GROUNDWATER AN ANALYSIS PROBLEM,
W71-04109 02K

METHODS OF COLLECTION AND ANALYSIS OF PLANKTON AND PERIPHYTON SAMPLES IN THE WATER POLLUTION SURVEILLANCE SYSTEM,
W71-04195 05A

ELIMINATION OF 'MEMORY' PEAKS ENCOUNTERED IN AQUEOUS-INJECTION GAS CHROMATOGRAPHY,
W71-04196 07B

PERIPHYTON BIOMASS-CHLOROPHYLL RATIO AS AN INDEX OF WATER QUALITY,
W71-04206 05A

ANNUAL PLANTS
ECOLOGICAL SIGNIFICANCE OF ALIEN PLANTS IN CALIFORNIA GRASSLANDS,
W71-04233 04A

ANTHROPOLOGY
RESPONSES OF NATIVE AND MIGRANT DESERT RESIDENTS TO ARID HEAT,
W71-04301 02I

ANTOFAGASTA
FEEDING A DESERT CITY ANTOFAGASTA, CHILE,
W71-04055 03F

APPALACHIAN MOUNTAIN REGION
THE INCIDENCE AND FORMATION OF MINE DRAINAGE POLLUTION - APPENDIX C TO 'REPORT FOR DEVELOPMENT OF WATER RESOURCES OF APPALACHIA'.
W71-03872 05B

STREAM POLLUTION BY COAL MINE DRAINAGE IN APPALACHIA.
W71-03873 05B

SURVEY OF COSTS ON METHODS FOR CONTROL OF ACID MINE DRAINAGE POLLUTION,
W71-03877 05B

APPALACHIAN REDEVELOPMENT
A REVIEW OF CURRENT RESEARCH ON COAL MINE DRAINAGE IN APPALACHIA,
W71-03874 05B

FACTORS THAT AFFECT THE FORMATION OF COAL MINE DRAINAGE POLLUTION IN APPALACHIA,
W71-03875 05B

THE OXIDATION OF PYRITE ASSOCIATED WITH COAL MINES,
W71-03876 05B

SURVEY OF COSTS ON METHODS FOR CONTROL OF ACID MINE DRAINAGE POLLUTION,
W71-03877 05B

APPROPRIATION
COMPETITION FOR WATER IN AN EXPANDING ECONOMY POLICIES AND INSTITUTIONS,
W71-04268 06E

AQUATIC ANIMALS
A CHAMBER FOR OFFERING ALTERNATIVE CONDITIONS TO SMALL MOTILE AQUATIC ANIMALS,
W71-03853 05C

THE EFFECT OF SOME SOLVENTS ON LOWER WATER ANIMALS AND ON FISHES,
W71-03854 05C

AQUATIC ENVIRONMENT
WATER QUALITY - BENTHIC INVERTEBRATE RELATIONSHIPS IN ESTUARIES,
W71-03922 05C

AQUATIC LIFE
STUDY OF WATER POLLUTION PROBLEMS WHICH AFFECT FISH AND OTHER AQUATIC FORMS,
W71-03852 05C

AQUATIC PLANTS
THE ROLE OF AQUATIC VASCULAR PLANTS IN THE EUTROPHICATION OF SELECTED LAKES IN WASTERN MASSACHUSETTS,
W71-03918 05C

AQUEDUCTS
WATER, A PROGRESS REPORT.
W71-03905 08A

AQUEOUS SOLUTIONS
DENTISTRY PROFESSOR EXPLAINS POLYWATER.
W71-03926 01B

THEORETICAL MEAN ACTIVITY COEFFICIENTS OF STRONG ELECTROLYTES IN AQUEOUS SOLUTIONS FROM 0 TO 100 DEG C,
W71-04183 01B

THE USE OF AMALGAM ELECTRODES TO MEASURE ACTIVITY COEFFICIENTS IN MULTICOMPONENT SALT SOLUTIONS,
W71-04221 01B

AQUIFER
UTILIZATION OF THE STORAGE POTENTIAL OF RIVER VALLEY AQUIFERS,
W71-03924 02F

AQUIFER TESTING
GEOHYDROLOGIC BOUNDARY ENVELOPES,
W71-04125 02F

AQUIFERS
OPTIMUM UTILIZATION AND MANAGEMENT OF WATER BEARING FORMATIONS HYDRAULICALLY CONNECTED TO A STRETCH OF THE CONNECTICUT RIVER,
W71-03919 04B

ARCTIC REGIONS
INVESTIGATION OF AIRFIELD DRAINAGE ARCTIC AND SUBARCTIC REGIONS, SUPPLEMENT TO PART I, FIELD RECONNAISSANCE AND ANALYSIS,
W71-04002 04A

ARID CLIMATES
RESPONSES OF NATIVE AND MIGRANT DESERT RESIDENTS TO ARID HEAT,
W71-04301 02I

ARID LANDS
FEEDING A DESERT CITY ANTOFAGASTA, CHILE,
W71-04055 03F

CLIMATE AND OVERGRAZING ON THE SHONTO PLATEAU, ARIZONA,
W71-04064 03F

THE CLIMATE OF INTERIOR OMAN,
W71-04227 02B

SECULAR VARIATION OF ARIDITY IN THE WORLD,
W71-04288 02A

DRY LANDS AND A HUNGRY WORLD,
W71-04291 06B

WATER AND CULTURE NEW DECISION RULES FOR OLD INSTITUTIONS,
W71-04296 06E

PERENNATION IN ASTRAGALUS LENTIGINOSUS AND TRIDENS PULCHELLUS IN RELATION TO RAINFALL,
W71-04299 02I

ROOT DEVELOPMENT OF TWO COMMON SPECIES IN DIFFERENT HABITATS IN THE MEDITERRANEAN SUBREGION IN EGYPT,
W71-04300 02I

ARIDITY INDEX
SOME ASPECTS OF DROUGHT CLIMATOLOGY OF THE DRY SUBHUMID ZONES OF SOUTH INDIA,
W71-04298 02B

ARIZONA
QUALITY OF RUNOFF FROM DIVERSIFIED URBAN WATERSHEDS,
W71-03929 05A

CLIMATE AND OVERGRAZING ON THE SHONTO PLATEAU, ARIZONA,
W71-04064 03F

WATER TABLE DECLINE AND RESULTANT AGRICULTURAL PATTERNS IN THE SALT RIVER VALLEY OF ARIZONA,
W71-04065 03F

ARSENIC COMPOUNDS
ARSENIC IN POTABLE DESERT GROUNDWATER AN ANALYSIS PROBLEM,
W71-04109 02K

A DIRECT-READING SPECTROCHEMICAL PROCEDURE FOR THE MEASUREMENT OF NINETEEN MINOR ELEMENTS IN NATURAL WATER,
W71-04211 05A

ARTIFICIAL PRECIPITATION
CLOUD SEEDING POTENTIALITIES IN LOS ANGELES COUNTY.
W71-03903 03B

A MORE RIGOROUS EXPRESSION FOR THE RATE OF DROPLET GROWTH,
W71-04005 03B

ARTIFICIAL RECHARGE
OPTIMUM UTILIZATION AND MANAGEMENT OF WATER BEARING FORMATIONS HYDRAULICALLY CONNECTED TO A STRETCH OF THE CONNECTICUT RIVER,
W71-03919 04B

UTILIZATION OF THE STORAGE POTENTIAL OF RIVER VALLEY AQUIFERS,
W71-03924 02F

ARTIFICIAL SUBSTRATES
USE OF A FLOATING PERIPHYTON SAMPLER FOR WATER POLLUTION SURVEILLANCE,
W71-04194 05B

A LIMESTONE-FILLED, ARTIFICIAL SUBSTRATE SAMPLER-FLOAT UNIT FOR COLLECTING MACROINVERTEBRATES IN LARGE STREAMS,
W71-04219 07B

ASIA
ENVELOPE-FREQUENCY RELATIONS FOR MAXIMUM FLOODS IN MONSOON AREAS OF THE ECAFE REGION.
W71-04117 02B

QUANTITATIVE REGIONAL PREDICTION OF RAINFALL IN ECAFE REGIONS,
W71-04152 02B

VERTICAL VELOCITY AND RAINFALL COMPUTATION,
W71-04153 02B

DETECTION OF PRECIPITATION BY RADAR,
W71-04154 07B

ANALYSIS OF RAINFALL OVER A SMALL AREA,
W71-04155 02B

RAIN FROM TROPICAL CYCLONES AND TROUGH-TYPE SYSTEMS,
W71-04156 02B

ANALYSIS OF MESOSCALE SYSTEMS,
W71-04157 02B

SURVEY OF OBJECTIVE METHODS USED IN HONG KONG FOR PREDICTING TYPHOON MOVEMENT,
W71-04158 02B

PREDICTION OF FLOODS FROM HEAVY RAINFALL,
W71-04159 02E

LECTURE 1 - FACTORS INFLUENCING RAINFALL FORMATION AND DISTRIBUTION,
W71-04160 02B

LECTURE 2 - PROBABLE MAXIMUM PRECIPITATION (PMP) ESTIMATION,

W71-04161 02B

LECTURE 3 - STORM MAXIMIZATION TECHNIQUES IN EQUATORIAL/TROPICAL REGIONS,
W71-04162 02B

LECTURE 4 - ESTIMATION OF PMP AND MAXIMUM FLOODS BY STATISTICAL METHODS,
W71-04163 02B

ASSESSMENTS
PEOPLE EX REL WESTERN NEW YORK AND P RY V STATE TAX COMM'N (ASSESSMENT OF RAILROAD BRIDGE AS A SPECIAL FRANCHISE).
W71-04342 06E

ATACAMA DESERT
FEEDING A DESERT CITY ANTOFAGASTA, CHILE,
W71-04055 03F

ATOMIC REACTORS
PROGRESS IN WATER DESALINATION TECHNOLOGY,
W71-04229 03A

AUSTRIA
STABLE ISOTOPES IN STUDY OF WATER BALANCE OF LAKE NEUSIEDL, AUSTRIA INVESTIGATION OF THE RELIABILITY OF THE STABLE ISOTOPE METHOD,
W71-04141 02A

AUTOMATION
EVALUATION REPORT 1 AUTOMATIC BEAKER SAMPLE CHANGER,
W71-04192 07B

ANALYTICAL INSTRUMENTS IN WATER POLLUTION CONTROL,
W71-04205 05A

AUTOTROPHIC INDEX
PERIPHYTON BIOMASS-CHLOROPHYLL RATIO AS AN INDEX OF WATER QUALITY,
W71-04206 05A

AVALANCHE CONTROL
ARTILLERY CONTROL OF AVALANCHES ALONG MOUNTAIN HIGHWAYS,
W71-04258 02C

AVALANCHES
ARTILLERY CONTROL OF AVALANCHES ALONG MOUNTAIN HIGHWAYS,
W71-04258 02C

BACKWATER
RAGAN V SUSQUEHANNA POWER CO (DAMAGES FOR FAILURE TO RELOCATE ROAD FLOODED BY DAM BACKWATER).
W71-04340 06E

BACTERIA
MICROBIAL POPULATIONS IN STUBBLE-MULCHED SOIL,
W71-04068 02G

PREDATOR-PREY RELATIONSHIPS IN A MODEL FOR THE ACTIVATED PROCESS,
W71-04070 05D

RESPIRATORY RELATIONSHIPS OF A SYMBIOTIC ALGAL-BACTERIAL CULTURE FOR WASTE WATER NUTRIENT REMOVAL,
W71-04079 05D

BACTERICIDES
THE PRESERVATION OF PHYTOPLANKTON GRAB SAMPLES,
W71-04207 05A

BASALTS
CHEMICAL EXCHANGE BETWEEN SEA WATER AND DEEP OCEAN BASALTS,
W71-03956 02K

BAYS
SAND WAVES AND TIDAL CHANNELS IN THE ENTRANCE TO CHESAPEAKE BAY,
W71-03958 02L

BEACH EROSION
VARIATION IN THE LEVEL OF THE CLIFF/SHORE PLATFORM JUNCTION ALONG THE SOUTH COAST OF GREAT BRITAIN,
W71-03952 02J

BEACHES
JACOBS V ELWELL (RIGHT TO PREVENT CONSTRUCTION ON BEACH).
W71-04318 06E

BEAKER BUTLER
EVALUATION REPORT 1 AUTOMATIC BEAKER SAMPLE CHANGER,
W71-04192 07B

BED LOAD
A MECHANICAL DEVICE FOR RELEASING FLUORESCENT TRACERS,
W71-03949 07B

HYDRAULIC CRITERIA OF STREAMS WITH A MOBILE BOTTOM,
W71-03965 02J

BEDLOAD FORMULAS. PART A. A SELECTION OF BEDLOAD FORMULAS. PART B. PROGRAM LISTINGS FOR BEDLOAD FORMULAS,
W71-03999 02E

BED SEDIMENT SAMPLING
ON THE ACCURACY OF BED-MATERIAL SAMPLING,
W71-04132 02J

BEDS UNDER WATER
IN RE CITY OF YONKERS (CONDEMNATION VALUE OF RIPARIAN LAND).
W71-03883 06E

IN RE LANDS ON UPPER NEW YORK BAY (EASEMENT IN SUBMERGED LANDS EXTINGUISHED BY RESOLUTION OF MUNICIPAL COUNCIL).
W71-04347 06E

BENEFICIAL USE
INSURING MAXIMUM BENEFICIAL USE OF WATER THROUGH LEGISLATION,
W71-04099 06E

BENEFIT-COST ANALYSIS
BENEFIT-COST ANALYSIS AND MULTIPLE OBJECTIVES CURRENT ISSUES IN WATER RESOURCES PLANNING,
W71-04023 06C

BENTHIC
WATER QUALITY - BENTHIC INVERTEBRATE RELATIONSHIPS IN ESTUARIES,
W71-03922 05C

BENTHIC FAUNA
USING MACROINVERTEBRATE COLLECTIONS FOR WATER QUALITY MONITORING IN THE OHIO RIVER BASIN 1963-1966,
W71-04208 05C

BIBLIOGRAPHIES
A REVIEW OF CURRENT RESEARCH ON COAL MINE DRAINAGE IN APPALACHIA,
W71-03874 05B

FACTORS THAT AFFECT THE FORMATION OF COAL MINE DRAINAGE POLLUTION IN APPALACHIA,
W71-03875 05B

THE OXIDATION OF PYRITE ASSOCIATED WITH COAL MINES,
W71-03876 05B

ABSTRACTS OF LITERATURE ON THE DISTILLATION OF SEAWATER AND ON THE USE OF NUCLEAR ENERGY FOR DESALTING.
W71-04226 03A

BIDS
CAN COSTS BE CUT.
W71-04284 06C

BIGORAY RIVER(ALBERTA)
LIMNOLOGICAL FEATURES OF A NORTHERN BROWN-WATER STREAM, WITH SPECIAL REFERENCES TO THE LIFE HISTORIES OF THE AQUATIC INSECTS,
W71-04215 05C

BIOCHEMICAL OXIDATION DEMAND
PROTOTYPE STUDIES OF COMBINED TREATMENT OF WASTES FROM 22 TANNERIES AND TWO MUNICIPALITIES,
W71-03892 05D

BIOCHEMICAL OXYGEN DEMAND
SPRAY IRRIGATION OF WASTES FROM THE MANUFACTURE OF HARDBOARD,
W71-03886 05D

BIOLOGICAL CHEMICAL COMBINATION DRAMATICALLY CUTS TREATMENT,
W71-04086 05D

BIODEGRADATION
MICROBIAL CARBONATE AND PHOSPHATE PRECIPITATES FROM SEA WATER CULTURES,
W71-03950 02K

BIODEGRADABILITY OF POTENTIAL ORGANIC SUBSTITUTES FOR PHOSPHATES,
W71-04072 05D

THE ANAEROBIC FILTER FOR WASTE TREATMENT,
W71-04075 05D

BIOFILTRATION
HIGH-RATE BIOFILTRATION PAST AND FUTURE,
W71-04076 05D

BIOINDICATORS
ARTIFICIAL SUBSTRATE SAMPLING, MACROINVERTEBRATES IN A POLLUTED REACH OF THE KLAMATH RIVER, OREGON,
W71-04191 05A

A NEW FRESHWATER CENTRIC DIATOM MICROSIPHONA POTAMOS GEN. ET SP. NOV.,
W71-04193 05C

USE OF A FLOATING PERIPHYTON SAMPLER FOR WATER POLLUTION SURVEILLANCE,
W71-04194 05B

PERIPHYTON BIOMASS-CHLOROPHYLL RATIO AS AN INDEX OF WATER QUALITY,
W71-04206 05A

USING MACROINVERTEBRATE COLLECTIONS FOR WATER QUALITY MONITORING IN THE OHIO RIVER BASIN 1963-1966,
W71-04208 05C

A GUIDE TO THE COMMON DIATOMS AT WATER POLLUTION SURVEILLANCE SYSTEM STATIONS,
W71-04210 07C

BIOLOGICAL COMMUNITIES
ECOLOGICAL SIGNIFICANCE OF ALIEN PLANTS IN CALIFORNIA GRASSLANDS,
W71-04233 04A

BIOLOGICAL REACTORS
KINETICS OF FIXED FILM BIOLOGICAL REACTORS,

W71-04085 05D

BIOLOGICAL SOLIDS PRODUCTION
THE ANAEROBIC FILTER FOR WASTE TREATMENT,
W71-04075 05D

BOD LOADING
DESIGN CONSTRUCTION AND MAINTENANCE OF WASTE STABILIZATION LAGOONS,
W71-03896 05D

BOGS
REMOTE GROUNDWATER LEVEL METER FOR BOG STATIONS,
W71-03966 07B

BORON
ADSORPTION OF BORON BY FERROMAGNESIAN MINERALS AND MAGNESIUM HYDROXIDE,
W71-03939 02G

BORON REMOVAL
DEVELOPMENT OF ECONOMICAL METHODS OF BORON REMOVAL FROM IRRIGATION RETURN WATERS,
W71-03914 05D

BOSTON HARBOR
MATHEMATICAL PROGRAMMING APPLICATIONS TO WATER QUALITY PLANNING FOR THE BOSTON HARBOR REGION,
W71-04036 05G

BOTTOM SEDIMENTS
MINERAL AND CHEMICAL COMPOSITION OF SEDIMENTS FROM THE STRAITS OF FLORIDA,
W71-03944 02J

EMPIRICAL RELATIONSHIPS BETWEEN MASS PHYSICAL PROPERTIES FOR RECENT MARINE SEDIMENTS OFF SOUTHERN CALIFORNIA,
W71-03951 02J

TIDAL SAND MOVEMENT BETWEEN SOME LINEAR SAND BANKS IN THE NORTH SEA OFF NORTHEAST NORFOLK,
W71-03953 02J

ROD-MOUNTED BOTTOM GRAB,
W71-03967 07B

ON THE ACCURACY OF BED-MATERIAL SAMPLING,
W71-04132 02J

BOTTOM-SEDIMENT SAMPLERS
ROD-MOUNTED BOTTOM GRAB,
W71-03967 07B

BOUNDARIES(PROPERTY)
BAUMHART V MCCLURE (OWNERSHIP OF RIPARIAN LAND AFTER SUSTAINED SUBMERGENCE).
W71-04330 06E

BOUNDARY DISPUTES
WYKLE V COLOMBO (APPORTIONMENT OF ACCRETIONS BETWEEN ADJACENT RIPARIAN OWNERS).
W71-04078 06E

HUNTER V VAN KEUREN (BOUNDARY DISPUTE AT LAKESHORE).
W71-04276 06E

WILSON V ST REGIS PULP AND PAPER CORP (BOUNDARY LINE BETWEEN PROPERTIES LOCATED ON OPPOSITE SIDES OF STREAM).
W71-04317 06E

POST V WILKES-BARRE CONNECTING RR (DESCRIPTION OF CHANNEL AS PROPERTY BOUNDARY WHERE BED LATER DRIES UP).
W71-04346 06E

BOUYOUCOS BLOCKS
LEAF SAMPLER FOR RELATIVE WATER CONTENT MEASUREMENTS DESIGN AND APPLICATION,
W71-04239 02I

BOWEN RATIO
POTENTIAL EVAPOTRANSPIRATION AND THE WATER BALANCE IN WEST AFRICA AN ALTERNATIVE METHOD OF PENMAN,
W71-04063 02D

BRIDGES
PEOPLE EX REL WESTERN NEW YORK AND P RY V STATE TAX COMM'N (ASSESSMENT OF RAILROAD BRIDGE AS A SPECIAL FRANCHISE).
W71-04342 06E

BRINE DISPOSAL
MINERAL RECOVERY FROM CONCENTRATED BRINES,
W71-04223 02K

BRINES
MINERAL RECOVERY FROM CONCENTRATED BRINES,
W71-04223 02K

BRUSH CONTROL
THE SAM SIMON WATERSHED SHRUB CONTROL,
W71-04058 03F

BULKHEAD LINE
BAY RIDGE DOCK CO V UNITED DRY DOCKS, INC (RIGHT TO FILL TO BULKHEAD LINE INCLUDES RIGHT TO MAINTAIN FLOATING DRY DOCK).
W71-04245 06E

BURCH CREEK(OGDEN
FLOOD PLAIN INFORMATION, BURCH CREEK, OGDEN, UTAH.
W71-04145 04A

BUREAU OF LAND MANAGEMENT
SUPERFARMS VS. SAGEBRUSH NEW IRRIGATION DEVELOPMENTS ON THE SNAKE RIVER PLAIN,
W71-04056 03F

BUREAU OF RECLAMATION
SUPERFARMS VS. SAGEBRUSH NEW IRRIGATION DEVELOPMENTS ON THE SNAKE RIVER PLAIN,
W71-04056 03F

BURMA
SEVERE CYCLONIC STORM RESPONSIBLE FOR FLASH FLOOD IN PAKOKKU AND MONYWA DISTRICTS DURING THE MONTH OF OCTOBER 1967,
W71-04164 02B

LOWER AND MIDDLE IRRAWADDY FLOODS IN RELATION TO HEAVY RAINFALL IN THE HEAD WATER REGIONS OF CHINDWIN AND IRRAWADDY RIVERS,
W71-04165 02E

BYPRODUCT RECOVERY
INDUSTRIAL WASTE DESALTING FOR BYPRODUCT RECOVERY,
W71-04286 05D

BYPRODUCTS
INDUSTRIAL WASTE DESALTING FOR BYPRODUCT RECOVERY,
W71-04286 05D

BY-PRODUCTS
MINERAL RECOVERY FROM CONCENTRATED BRINES,
W71-04223 02K

CALCAREOUS SOIL
MOVEMENT OF ALGAL- AND FUNGAL-BOUND RADIOSTRONTUM AS CHELATE COMPLEXES IN A CALCAREOUS SOIL,
W71-04067 05B

CALGARY
A STUDY OF WATER USE IN SINGLE-DWELLING RESIDENCES IN THE CITY OF CALGARY, ALBERTA, ALBERTA UNIV., EDMONTON (CANADA),
W71-04287 03D

CALIBRATIONS
THE UNIVERSALISATION OF THE CO-ORDINATES OF LOGARITHMIC WEIR PROFILES,
W71-04127 07B

EXPERIMENTAL STUDIES ON LINEAR PROPORTIONAL WEIRS WITH TRIANGULAR BOTTOMS,
W71-04129 08B

CALIFORNIA
WATER, A PROGRESS REPORT.
W71-03905 08A

ARSENIC IN POTABLE DESERT GROUNDWATER AN ANALYSIS PROBLEM,
W71-04109 02K

EFFECT OF SOLID WASTE DISPOSAL ON GROUNDWATER QUALITY,
W71-04116 05C

ECOLOGICAL SIGNIFICANCE OF ALIEN PLANTS IN CALIFORNIA GRASSLANDS,
W71-04233 04A

CANADA
DISTRIBUTION OF HYDROGEN ISOTOPES IN CANADIAN WATERS,
W71-04134 02A

PERCH LAKE EVAPORATION STUDY,
W71-04142 02A

CANAL CONSTRUCTION
WEST SHORE RR V STATE (LIABILITY FOR APPROPRIATION OF RIVER FLOW FOR NEW CHANNEL OUTSIDE RIVER).
W71-04321 06E

CANAL EMBANKMENTS
MENTELSON V STATE (LIABILITY FOR FLOOD DAMAGE RESULTING FROM STATE'S OBSTRUCTION OF DRAINAGE CHANNEL).
W71-04018 06E

CANALS
HYDRAULIC RACE CO V GREENE (INTERPRETATION OF LEASE PROVIDING FOR USE OF ALL SURPLUS WATERS OF CANAL).
W71-04074 06E

KIRK V PROVIDENCE MILL CO (SURPLUS WATER RIGHTS SUBJECT TO STATE'S RIGHT TO ABANDON AND DRAIN CANAL).
W71-04344 06E

CANYONS
SOME ASPECTS OF THE GEOMORPHOLOGY OF THE AIR MOUNTAINS, SOUTHERN SAHARA,
W71-04050 02G

CAPILLARY ACTION
DENTISTRY PROFESSOR EXPLAINS POLYWATER.
W71-03926 01B

CARBON DIOXIDE
MINE WASTE WATER PROBLEMS IN EUROPE,
W71-03898 05D

CARBONATES
MICROBIAL CARBONATE AND PHOSPHATE PRECIPITATES FROM SEA WATER CULTURES,
W71-03950 02K

CASCADE WATERSHED-MODEL
A SIMPLE CASCADE WATERSHED MODEL,
W71-04181 02A

CASSAVA
FARMING, FOREST AND SAVANNA IN WESTERN NIGERIA,
W71-04054 03F

CATALOG OF INFORMATION ON WATER DATA
CATALOG OF INFORMATION ON WATER DATA, EDITION 1970 - INDEX TO WATER QUALITY SECTION.
W71-04150 07C

CATALOG OF INFORMATION ON WATER DATA, EDITION 1970-INDEX TO SURFACE WATER SECTION.
W71-04151 07C

CATFISHES
INFLUENCE OF TEMPERATURE AND PHOTOPERIOD ON GROWTH, FOOD CONSUMPTION AND FOOD CONVERSION EFFICIENCY OF CHANNEL CATFISH,
W71-03920 05C

CATION ADSORPTION
THE DIFFUSION OF COPPER, MANGANESE, AND ZINC AS AFFECTED BY CONCENTRATION, CLAY MINERALOGY, AND ASSOCIATED ANIONS,
W71-03942 02G

CAYUGA LAKE(N
EUTROPHICATION OF WATER RESOURCES OF NEW YORK STATE, OBSERVATIONS ON NUTRIENT LIMITATION ON SUMMER PHYTOPLANKTON IN CAYUGA LAKE, 1967 AND 1968,
W71-03923 02H

CEDAR RAPIDS(IOWA)
FLOOD PROFILE STUDY, HOOSIER CREEK, LINN COUNTY, IOWA,
W71-03932 02E

CHANNEL CATFISH
INFLUENCE OF TEMPERATURE AND PHOTOPERIOD ON GROWTH, FOOD CONSUMPTION AND FOOD CONVERSION EFFICIENCY OF CHANNEL CATFISH,
W71-03920 05C

CHANNEL FLOW
SAND WAVES AND TIDAL CHANNELS IN THE ENTRANCE TO CHESAPEAKE BAY,
W71-03958 02L

THE EFFECT OF VEGETATION CONVERSION AND FLOOD DISCHARGE ON STREAM CHANNEL GEOMETRY THE CASE OF SOUTHERN CALIFORNIA WATERSHEDS,
W71-04230 04D

CHANNEL FORM RATIO
THE EFFECT OF VEGETATION CONVERSION AND FLOOD DISCHARGE ON STREAM CHANNEL GEOMETRY THE CASE OF SOUTHERN CALIFORNIA WATERSHEDS,
W71-04230 04D

CHANNEL MORPHOLOGY
INFLUENCE OF THE BANKS AND FLOOD PLAIN ON CHANNEL CONVEYANCE,
W71-03968 02E

RECONSTRUCTION OF SUBGLACIAL RELIEF FROM RADIO ECHO SOUNDING RECORDS,
W71-04112 02C

CHAIN MODEL OF RIVER MEANDERS,
W71-04124 02E

CHANNELS
BEDLOAD FORMULAS. PART A. A SELECTION OF BEDLOAD FORMULAS. PART B. PROGRAM LISTINGS FOR BEDLOAD FORMULAS,
W71-03999 02E

CHAPARRAL
THE EFFECT OF VEGETATION CONVERSION AND FLOOD DISCHARGE ON STREAM CHANNEL GEOMETRY THE CASE OF SOUTHERN CALIFORNIA WATERSHEDS,
W71-04230 04D

WETTING AGENT FAILS TO CURB EROSION FROM BURNED WATERSHED,
W71-04250 04D

CHELATION
MOVEMENT OF ALGAL- AND FUNGAL-BOUND RADIOSTRONTUM AS CHELATE COMPLEXES IN A CALCAREOUS SOIL,
W71-04067 05B

BIODEGRADABILITY OF POTENTIAL ORGANIC SUBSTITUTES FOR PHOSPHATES,
W71-04072 05D

CHEMICAL ANALYSES
FWPCA METHODS FOR CHEMICAL ANALSIS OF WATER AND WASTES.
W71-04202 05A

CHEMICAL ANALYSIS
SPECTROPHOTOMETRIC DETERMINATION OF THIOCYANATE AND OXALATE,
W71-03928 05A

WATER-QUALITY DATA FOR THE FLAMING GORGE RESERVOIR AREA, UTAH AND WYOMING,
W71-03936 07C

SPECTROPHOTOMETRIC DETERMINATION OF CHLORATE ION,
W71-03994 02K

EVALUATION REPORT 1 AUTOMATIC BEAKER SAMPLE CHANGER,
W71-04192 07B

FWPCA METHOD STUDY 1 MINERAL AND PHYSICAL ANALYSES - AN EVALUATION OF FWPCA ANALYTICAL METHODS FOR SURFACE WATERS,
W71-04200 05A

ANALYTICAL INSTRUMENTS IN WATER POLLUTION CONTROL,
W71-04205 05A

CHEMICAL ANALYSIS(CHLORATE ION)
SPECTROPHOTOMETRIC DETERMINATION OF CHLORATE ION,
W71-03994 02K

CHEMICAL INTERFERENCE
ELIMINATION OF 'MEMORY' PEAKS ENCOUNTERED IN AQUEOUS-INJECTION GAS CHROMATOGRAPHY,
W71-04196 07B

CHEMICAL OXYGEN DEMAND
SPRAY IRRIGATION OF WASTES FROM THE MANUFACTURE OF HARDBOARD,
W71-03886 05D

MULTI-STAGE BIOLOGICAL PROCESSES FOR WASTE TREATMENT,
W71-03894 05D

CHEMICAL POTENTIAL
THEORETICAL MEAN ACTIVITY COEFFICIENTS OF STRONG ELECTROLYTES IN AQUEOUS SOLUTIONS FROM 0 TO 100 DEG C,
W71-04183 01B

CHEMICAL PRECIPITATION
CHEMICAL PRECIPITATION OF PHOSPHATE WITHIN A HIGH RATE BIO OXIDATION SYSTEM I. SYNTHETIC SEWAGE STUDIES,
W71-03900 05D

CHEMICAL RECOVERY
PESTICIDES IN SURFACE WATERS OF THE UNITED STATES A FIVE-YEAR SUMMARY 1964-1968,
W71-04201 05A

METHOD SELECTION STUDY 1 A COMPARISON OF THREE MODIFICATIONS OF THE SINGLE REAGENT METHOD FOR SOLUBLE ORTHOPHOSPHATE,
W71-04204 05A

CHESAPEAKE BAY
ECONOMIC ANALYSIS OF MARINAS IN MARYLAND,
W71-04267 06D

CHESAPEAKE BAY ENTRANCE
SAND WAVES AND TIDAL CHANNELS IN THE ENTRANCE TO CHESAPEAKE BAY,
W71-03958 02L

CHEZY EQUATION
INFLUENCE OF THE BANKS AND FLOOD PLAIN ON CHANNEL CONVEYANCE,
W71-03968 02E

CHILE
FEEDING A DESERT CITY ANTOFAGASTA, CHILE,
W71-04055 03F

CHLORIDES
ACTION OF IRON SALTS IN SOLUTION ON GOLDFISH,
W71-03851 05C

SPECTROPHOTOMETRIC DETERMINATION OF CHLORATE ION,
W71-03994 02K

CHLORINATED HYDROCARBON PESTICIDES
GAS CHROMATOGRAPHIC SEPARATIONS OF MIXED CHLORINATED FUNGICIDES,
W71-04213 05A

CHLORINATED HYDROCARBONS
METABOLIC RESPONSE OF ACTIVATED SLUDGE TO SODIUM PENTACHLOROPHENOL,
W71-04088 05D

CHLOROPHYLL
PERIPHYTON BIOMASS-CHLOROPHYLL RATIO AS AN INDEX OF WATER QUALITY,
W71-04206 05A

CHROMATOGRAPHY
GAS CHROMATOGRAPHIC SEPARATIONS OF MIXED CHLORINATED FUNGICIDES,
W71-04213 05A

THE ELECTRON CAPTURE DETECTOR IN THE ANALYSIS OF CHLORINATED HYDROCARBON PESTICIDES IN TISSUES WITH AND WITHOUT CLEAN-UP,
W71-04214 05A

CHROMIUM
PROTOTYPE STUDIES OF COMBINED TREATMENT OF WASTES FROM 22 TANNERIES AND TWO MUNICIPALITIES,
W71-03892 05D

CITIES
WATER RESOURCES PLANNING IN THE URBAN-METROPOLITAN CONTEXT,
W71-03861 06B

POWER OF CITIES AND TOWNS TO PROVIDE DRAINAGE AND SEWAGE FACILITIES.
W71-04081 06E

PENNSYLVANIA RR V LINCOLN TRUST CO (RAILROAD AND MUNICIPAL NEGLIGENCE IN MAINTAINING WATER PURITY).
W71-04252 06E

CITYCO REALTY CO V MAYOR, COUNSELOR, AND ALDERMAN OF ANNAPOLIS (RIGHT OF CITY TO DISCHARGE SEWAGE INTO STREAM).

W71-04319 06E

IN RE LANDS ON UPPER NEW YORK BAY (EASEMENT IN SUBMERGED LANDS EXTINGUISHED BY RESOLUTION OF MUNICIPAL COUNCIL).
W71-04347 06E

IN RE INWOOD HILL PARK (CONDEMNATION OF CITY'S OWN LAND FOR PARK).
W71-04349 06E

CITRUS FRUITS
ASPECTS OF THE SOUTH AUSTRALIAN CITRUS INDUSTRY,
W71-04051 03F

ROOTSTOCKS FOR VALENCIA ORANGES AND LISBON LEMONS IN ARIZONA,
W71-04059 03F

CITY COUNCILS
STRUCTURE OF PUBLICLY-OWNED WATER UTILITIES,
W71-04281 06E

CLASSIFICATION
A NEW APPROACH TO THE CLASSIFICATION OF CLIMATE,
W71-04235 02B

CLAY LOAM
PEDOGENIC DISTRIBUTION OF ZINC IN MOLLISOLS AND ASSOCIATED ENTISOLS IN NEBRASKA,
W71-03940 02G

CLAY MINERALS
THE DIFFUSION OF COPPER, MANGANESE, AND ZINC AS AFFECTED BY CONCENTRATION, CLAY MINERALOGY, AND ASSOCIATED ANIONS,
W71-03942 02G

EMPIRICAL RELATIONSHIPS BETWEEN MASS PHYSICAL PROPERTIES FOR RECENT MARINE SEDIMENTS OFF SOUTHERN CALIFORNIA,
W71-03951 02J

CLEAR-CUTTING
INCREASES IN WATER YIELD FOLLOWING CLEAR-CUT LOGGING IN THE PACIFIC NORTHWEST,
W71-04240 03B

CLIMATES
SOME CHARACTERISTICS OF THE THERMAL REGIME OF RIVERS IN THE DANUBE AND DNIESTER BASINS,
W71-03974 02K

CLIMATIC CLASSIFICATION
SECULAR VARIATION OF ARIDITY IN THE WORLD,
W71-04288 02A

CLIMATIC DATA
SPRAY IRRIGATION OF WASTES FROM THE MANUFACTURE OF HARDBOARD,
W71-03886 05D

AGROMETEOROLOGY SURVEY OF THE HIGHLANDS OF EASTERN AFRICA,
W71-04062 02D

POTENTIAL EVAPOTRANSPIRATION AND THE WATER BALANCE IN WEST AFRICA AN ALTERNATIVE METHOD OF PENMAN,
W71-04063 02D

THE CLIMATE OF INTERIOR OMAN,
W71-04227 02B

A NEW APPROACH TO THE CLASSIFICATION OF CLIMATE,
W71-04235 02B

SECULAR VARIATION OF ARIDITY IN THE WORLD,
W71-04288 02A

SOME ASPECTS OF DROUGHT CLIMATOLOGY OF THE DRY SUBHUMID ZONES OF SOUTH INDIA,
W71-04298 02B

CLIMATIC TYPES
A NEW APPROACH TO THE CLASSIFICATION OF CLIMATE,
W71-04235 02B

CLIMATIC ZONES
A NEW APPROACH TO THE CLASSIFICATION OF CLIMATE,
W71-04235 02B

SECULAR VARIATION OF ARIDITY IN THE WORLD,
W71-04288 02A

CLIMATOLOGY
CLIMATE AND OVERGRAZING ON THE SHONTO PLATEAU, ARIZONA,
W71-04064 03F

SOME EXAMPLES OF HEAVY RAINFALL IN JAPAN,
W71-04166 02B

THE PROBLEM OF FLOOD PREDICTION ON THE EAST COAST OF WEST MALAYSIA,
W71-04167 02B

HEAVY RAINFALL IN PAKISTAN AND ITS ASSOCIATED FLOOD,
W71-04168 02B

HEAVY RAINFALL AND ASSOCIATED FLOODS IN WEST PAKISTAN,
W71-04169 02B

THE CIRCULATION PATTERN OVER SINGAPORE AND THE EAST COAST OF WEST MALAYSIA DURING JANUARY AND FEBRUARY 1967 COMPARED WITH THAT OF JANUARY AND FEBRUARY 1968,
W71-04170 02B

CLOUD PHYSICS
CLOUD SEEDING POTENTIALITIES IN LOS ANGELES COUNTY.
W71-03903 03B

CLOUD SEEDING
CLOUD SEEDING POTENTIALITIES IN LOS ANGELES COUNTY.
W71-03903 03B

COAL MINE WASTES
TREATMENT OF ACID MINE DRAINAGE BY FOAM SEPARATION,
W71-04188 05D

COAL MINES
FEASIBILITY STUDY OF MINING COAL IN AN OXYGEN FREE ATMOSPHERE.
W71-04187 05G

LEHIGH AND WILKES-BARRE COAL MINING CO V PITTSTON COAL MINING CO (DISCHARGE OF HYDRAULIC MINING WATER INTO CONTIGUOUS MINE).
W71-04332 06E

COLOR
ENVIRONMENTAL CONTROL OF COLORATION IN AN ACRIDID, GASTRIMARGUS AFRICANUS (SAUSSURE),
W71-04302 03F

COLORADO
STUDY OF MOLYBDENUM IN PUBLIC WATER SUPPLY,
W71-04120 05A

COMBINED SEWER OVERFLOWS
ECORSE RIVER WATER QUALITY STUDY, MAY-JULY, 1969.
W71-03907 05B

COMPENSATION
IN RE CITY OF YONKERS (CONDEMNATION VALUE OF RIPARIAN LAND).
W71-03883 06E

TOWN OF PERU V STATE (COMPENSATION FOR STATE'S APPROPRIATION OF TOWN'S DOCK).
W71-04310 06E

COMPETING USES
GEOGRAPHICAL ASPECTS OF THE USE OF WATER RESOURCES IN THE SOVIET ECONOMY,
W71-04052 03F

COMPUTER MODELS
USING COMPUTERS TO HELP EVALUATE FLOOD PROTECTION MEASURES,
W71-04293 07C

COMPUTER PROGRAMS
OPTIMIZATION FOR PLANNING AND LOCATION OF PRECIPITATION STATIONS IN THE JEMEZ MOUNTAINS,
W71-04033 06A

COMPUTER AIDS GROUNDWATER RESOURCES RESEARCH PROJECT,
W71-04057 02F

OPTIMUM FIRE POWER OUTPUT FROM A TWO RESERVOIR SYSTEM BY INCREMENTAL DYNAMIC PROGRAMMING,
W71-04111 04A

CALCULATION OF FLOOD WAVES FOR A LARGE RIVER SYSTEM,
W71-04176 02E

USING COMPUTERS TO HELP EVALUATE FLOOD PROTECTION MEASURES,
W71-04293 07C

COMPUTER SIMULATION
COMPUTER DESIGN OF SEWAGE TREATMENT PLANTS,
W71-03893 05D

COMPUTERS
MATHEMATICAL MODELS AS AN AID IN THE SOLUTION OF WATER POLLUTION CONTROL PROBLEMS,
W71-03884 05G

CONCRETE
HOT-THERMOS METHOD OF CONCRETING,
W71-03997 08F

CONCRETE CONTROL
CONCRETE FOR KRASNOLARSK DAM,
W71-04004 08F

CONCRETE DAMS
CONCRETE FOR KRASNOLARSK DAM,
W71-04004 08F

CONCRETE MIXES
CONCRETE FOR KRASNOLARSK DAM,
W71-04004 08F

CONCRETE PLANTS
CONCRETE FOR KRASNOLARSK DAM,
W71-04004 08F

CONCRETE TECHNOLOGY
PRECAST REINFORCED CONCRETE IN HYDRAULIC CONSTRUCTION,
W71-04015 08F

SARATOV HYDROELECTRIC POWERPLANT CONSTRUCTION DATA,
W71-04017 08C

CONDEMNATION
IN RE CITY OF YONKERS (CONDEMNATION VALUE OF RIPARIAN LAND).
W71-03883 06E

THE DOCTRINE OF CONSEQUENTIAL LOSS AS AFFECTED BY VALUATION FORMULAS,
W71-04031 06E

CHICK SPRINGS WATER CO V STATE HIGHWAY DEP'T (STATE'S LIABILITY FOR INVERSE CONDEMNATION WHEN INADEQUATE CULVERT CAUSES FLOODING).
W71-04197 06E

LOWE V INDIANA HYDROELECTRIC POWER CO (AUTHORITY OF HYDROELECTRIC COMPANY TO CONDEMN LAND FOR FLOWAGE).
W71-04217 06E

PARKS V PENNSYLVANIA RR (TITLE TO LAND PREVIOUSLY FLOOD BY BACKWATER).
W71-04243 06E

MANNING V METROPOLITAN DISTRICT COMM'N (CONSTITUTIONALITY OF ACT AUTHORIZING CONDEMNATION FOR DRAINAGE).
W71-04279 06E

WEST SHORE RR V STATE (LIABILITY FOR APPROPRIATION OF RIVER FLOW FOR NEW CHANNEL OUTSIDE RIVER).
W71-04321 06E

BOOBER V TOWNE (ROAD DEPARTMENT'S LIABILITY FOR INCREASING THE FLOW OF WATER OVER CONTIGUOUS LAND).
W71-04333 06E

IN RE LANDS ON UPPER NEW YORK BAY (EASEMENT IN SUBMERGED LANDS EXTINGUISHED BY RESOLUTION OF MUNICIPAL COUNCIL).
W71-04347 06E

IN RE INWOOD HILL PARK (CONDEMNATION OF CITY'S OWN LAND FOR PARK).
W71-04349 06E

CONDEMNATION VALUE
THE DOCTRINE OF CONSEQUENTIAL LOSS AS AFFECTED BY VALUATION FORMULAS,
W71-04031 06E

APPEAL OF PHILADELPHIA FELT CO (CONDEMNATION VALUE OF RIPARIAN LAND).
W71-04334 06E

IN RE INWOOD HILL PARK (CONDEMNATION OF CITY'S OWN LAND FOR PARK).
W71-04349 06E

CONSTITUTIONALITY
MANNING V METROPOLITAN DISTRICT COMM'N (CONSTITUTIONALITY OF ACT AUTHORIZING CONDEMNATION FOR DRAINAGE).
W71-04279 06E

FEDERAL WATER-POWER LEGISLATION,
W71-04307 06E

HALEY V DAVENPORT (CONSTITUTIONALITY OF STATUTE AUTHORIZING TRESPASS TO DRAIN SWAMPS AND PONDS).
W71-04341 06E

CONSTITUTIONS
CHICK SPRINGS WATER CO V STATE HIGHWAY DEP'T (STATE'S LIABILITY FOR INVERSE CONDEMNATION WHEN INADEQUATE CULVERT CAUSES FLOODING).
W71-04197 06E

CONSTRUCTION
WATER, A PROGRESS REPORT.
W71-03905 08A

INVESTIGATION OF AIRFIELD DRAINAGE ARCTIC AND SUBARCTIC REGIONS, SUPPLEMENT TO PART I, FIELD RECONNAISSANCE AND ANALYSIS,
W71-04002 04A

THE CONTROL OF EROSION AND SEDIMENT IN HIGHWAY CONSTRUCTION,
W71-04149 04D

CONSTRUCTION COSTS
CONSTRUCTION COST OUTLOOK - 1970-1971,
W71-04275 06C

CAN COSTS BE CUT,
W71-04284 06C

CONSTRUCTION JOINTS
PRECAST REINFORCED CONCRETE IN HYDRAULIC CONSTRUCTION,
W71-04015 08F

CONTAMINATED WATER SUPPLY
PENNSYLVANIA RR V LINCOLN TRUST CO (RAILROAD AND MUNICIPAL NEGLIGENCE IN MAINTAINING WATER PURITY).
W71-04252 06E

CONTINENTAL SHELF
CONTINENTAL SHELF LAW OUTDISTANCED BY SCIENCE AND TECHNOLOGY,
W71-04100 06E

TOWARDS A BETTER USE OF THE OCEAN CONTEMPORARY LEGAL PROBLEMS IN OCEAN DEVELOPMENT,
W71-04338 06E

CONTOUR FURROWS
DO CONTOUR TRENCHES REDUCE WET-MANTLE FLOOD PEAKS,
W71-04262 04A

INFILTRATION IN CONTOUR TRENCHES IN THE SIERRA NEVADA,
W71-04263 04A

CONTOUR TRENCHES
DO CONTOUR TRENCHES REDUCE WET-MANTLE FLOOD PEAKS,
W71-04262 04A

INFILTRATION IN CONTOUR TRENCHES IN THE SIERRA NEVADA,
W71-04263 04A

CONTOURS
INFILTRATION IN CONTOUR TRENCHES IN THE SIERRA NEVADA,
W71-04263 04A

CONTRA COSTA COUNTY
AN ECONOMIC EVALUATION OF THE WATER QUALITY ASPECTS OF CONTRA COSTA COUNTY'S OFFSHORE WATER SUPPLY.
W71-03909 06B

THE ECONOMIC IMPACT OF ALTERNATIVE WATER CONDITIONS, A REPORT TO THE CONTRA COSTA COUNTY WATER AGENCY.
W71-03910 06B

CONTRACTS
HYDRAULIC RACE CO V GREENE (INTERPRETATION OF LEASE PROVIDING FOR USE OF ALL SURPLUS WATERS OF CANAL).
W71-04074 06E

DUCK ISLAND HUNTING AND FISHING CLUB V EDWARD GILLEN DOCK, DREDGE AND CONSTRUCTION CO (DISSOLUTION OF DRAINAGE DISTRICT).
W71-04277 06E

CONTROL SURFACE LAYER
SATURATION-UNSATURATION TRANSITION IN INFILTRATION TO A NON-UNIFORM SOIL PROFILE,
W71-04066 02G

COOLING TOWERS
ECONOMICS OF THERMAL POLLUTION CONTROL,
W71-04084 05D

CORN(FIELD)
EVALUATION OF IRRIGATION WATER AND NITROGEN FERTILIZER IN CORN PRODUCTION,
W71-04304 03F

CORRELATION ANALYSIS
OPTIMIZATION FOR PLANNING AND LOCATION OF PRECIPITATION STATIONS IN THE JEMEZ MOUNTAINS,
W71-04033 06A

COST ANALYSIS
SURVEY OF COSTS ON METHODS FOR CONTROL OF ACID MINE DRAINAGE POLLUTION,
W71-03877 05B

ECONOMIC ANALYSIS OF MARINAS IN MARYLAND,
W71-04267 06D

COST COMPARISONS
EVALUATION OF THE VERTICAL TUBE EVAPORATOR AND THE MULTISTAGE FLASH DESALINATION PROCESSES.
W71-03913 03A

COST REDUCTION
CAN COSTS BE CUT,
W71-04284 06C

COST TRENDS
CONSTRUCTION COST OUTLOOK - 1970-1971,
W71-04275 06C

COSTS
PRIVATE AND SOCIAL COSTING AND PRICING AS DECISION DETERMINANTS,
W71-03863 06C

PRIVATE AND SOCIAL COSTING AS DECISION DETERMINANTS IN WATER RESOURCES,
W71-03864 06B

BOLSA ISLAND NUCLEAR POWER AND DESALTING PROJECT FACILITIES (COST AND DESCRIPTION) AND COST OF DESALTED WATER,
W71-03915 03A

OPTIMIZATION OF WATER RESOURCE SYSTEMS INCORPORATING EARTHQUAKE RISK PROGRESS REPORT NO 1,
W71-04041 06A

ECONOMIC FEASIBILITY OF SELECTIVE ADJUSTMENT IN USE OF SALVAGEABLE WATERS IN THE TUCSON REGION, ARIZONA,
W71-04269 05D

COST-BENEFIT ANALYSIS
NEW HORIZONS IN WATER RESOURCES ADMINISTRATION,
W71-03887 06E

TOOLS FOR WATER-RESOURCE STUDY,
W71-04027 06A

WATERSHED PROJECTS.
W71-04104 06E

PROGRESS IN WATER DESALINATION TECHNOLOGY,
W71-04229 03A

AN ECONOMIC ANALYSIS OF LEVEL BENCH SYSTEMS FOR FORAGE PRODUCTION IN NORTH DAKOTA,
W71-04265 03F

ASPECTS OF PLANNING, EVALUATION, AND DECISION-MAKING IN SPORT FISHERY MANAGEMENT.

W71-04271 06B

THE ROLE OF ECONOMIC EVALUATION IN GOVERNMENTAL ANALYSIS,
W71-04272 06B

A GUIDE TO USING INTEREST FACTORS IN ECONOMIC ANALYSIS OF WATER PROJECTS,
W71-04283 06B

DRY LANDS AND A HUNGRY WORLD,
W71-04291 06B

COWLITZ COUNTY(WASHINGTON)
AVAILABILITY OF GROUNDWATER IN WESTERN COWLITZ COUNTY, WASHINGTON,
W71-03934 02F

CRITICAL SPEED
DETERMINING THE CRITICAL SPEEDS OF HYDRAULIC UNIT SHAFTS,
W71-03996 08C

CROP LOSSES
ELEVATION AND TEMPERATURE EFFECTS ON SEVERITY OF MAIZE DWARF MOSAIC VIRUS IN SORGHUM,
W71-04060 03F

CROP PRODUCTION
ASPECTS OF THE SOUTH AUSTRALIAN CITRUS INDUSTRY,
W71-04051 03F

SUPERFARMS VS. SAGEBRUSH NEW IRRIGATION DEVELOPMENTS ON THE SNAKE RIVER PLAIN,
W71-04056 03F

THE LOCATION OF LAND USE TYPES THE NILE VALLEY IN NORTHERN SUDAN,
W71-04228 04A

NEW APPROACHES TO IRRIGATED FARMING IN THE SUDAN ORGANIZATION AND MANAGEMENT,
W71-04231 03F

IRRIGATION DEVELOPMENT IN TUNISIA,
W71-04232 03F

ALTERNATIVE CROP ENTERPRISE BUDGETS FOR IRRIGATED PRODUCTION, SOUTHWESTERN OKLAHOMA,
W71-04294 03F

CROP RESPONSE
INFLUENCE OF LOW RATES OF WATER APPLICATION BY SPRINKLERS ON THE MICROCLIMATE,
W71-03925 02D

ROOTSTOCKS FOR VALENCIA ORANGES AND LIBSON LEMONS IN ARIZONA,
W71-04059 03F

CROPS
FARMING, FOREST AND SAVANNA IN WESTERN NIGERIA,
W71-04054 03F

AGROMETEOROLOGY SURVEY OF THE HIGHLANDS OF EASTERN AFRICA,
W71-04062 02D

CULVERTS
CHICK SPRINGS WATER CO V STATE HIGHWAY DEP'T (STATE'S LIABILITY FOR INVERSE CONDEMNATION WHEN INADEQUATE CULVERT CAUSES FLOODING).
W71-04197 06E

LAND DEVELOPMENT, INC V LOUISVILLE GAS AND ELECTRIC CO (LIABILITY FOR FAULTY CONSTRUCTION OF CULVERT DIVERTING STREAM).
W71-04312 06E

CURRENTS(WATER)
MINERAL AND CHEMICAL COMPOSITION OF SEDIMENTS FROM THE STRAITS OF FLORIDA,
W71-03944 02J

CZECHOSLOVAKIA
VARIATION OF THE TRITIUM AND OXYGEN-18 CONTENT IN PRECIPITATION AND SNOWPACK IN A REPRESENTATIVE BASIN IN CZECHOSLOVAKIA,
W71-04135 02A

DAM FAILURE
MENTELSON V STATE (LIABILITY FOR FLOOD DAMAGE RESULTING FROM STATE'S OBSTRUCTION OF DRAINAGE CHANNEL).
W71-04018 06E

DAMAGES
THE DOCTRINE OF CONSEQUENTIAL LOSS AS AFFECTED BY VALUATION FORMULAS,
W71-04031 06E

DAMS
SEDIMENT TRANSPORT IN DEGRADING RIVERS,
W71-03995 02J

STRESS DISTRIBUTION INSIDE HOMOGENEOUS ROCK-TALUS DAMS,
W71-04003 08A

INFORMATION FOR APPLICANTS FOR CONSTRUCTION, ALTERATION, OR REPAIR OF DAMS.
W71-04094 06E

LITTLE FALLS FIBRE CO V HENRY FORD AND SON, INC (FLASHBOARDS REDUCING RIPARIAN OWNER'S POWER HEAD).
W71-04203 06E

LOWE V INDIANA HYDROELECTRIC POWER CO (AUTHORITY OF HYDROELECTRIC COMPANY TO CONDEMN LAND FOR FLOWAGE).
W71-04217 06E

APPEAL OF PHILADELPHIA FELT CO (CONDEMNATION VALUE OF RIPARIAN LAND).
W71-04334 06E

RAGAN V SUSQUEHANNA POWER CO (DAMAGES FOR FAILURE TO RELOCATE ROAD FLOODED BY DAM BACKWATER).
W71-04340 06E

GARDEN CLUB OF VIRGINIA V VIRGINIA PUBLIC SERVICE CO (JURISDICTION OF CORPORATION COMMISSION TO GRANT PERMIT FOR DAM ON NON=NAVIGABLE RIVER).
W71-04343 06E

DUNBAR V BD OF COMM'RS OF ALBEMARLE DRAINAGE DIST (FAILURE OF DRAINAGE DISTRICT TO ERECT DAM CAUSES CROP FLOODING).
W71-04345 06E

DAPHNIA MAGNA
THE EFFECT OF SOME SOLVENTS ON LOWER WATER ANIMALS AND ON FISHES,
W71-03854 05C

DATA BANK
COMPUTER AIDS GROUNDWATER RESOURCES RESEARCH PROJECT,
W71-04057 02F

DATA CODING
1969 RESERVOIR LAND USE SURVEYS FIELD REPORT AND PROCEDURAL MANUAL,
W71-04039 04A

DATA COLLECTIONS
QUALITY OF RUNOFF FROM DIVERSIFIED URBAN WATERSHEDS,
W71-03929 05A

GROUNDWATER RESOURCES OF COLLINGSWORTH COUNTY, TEXAS,
W71-03935 02F

1969 RESERVOIR LAND USE SURVEYS FIELD REPORT AND PROCEDURAL MANUAL,
W71-04039 04A

QUALITY OF SURFACE WATERS OF THE UNITED STATES, 1965 PARTS 7 AND 8. LOWER MISSISSIPPI RIVER BASIN AND WESTERN GULF OF MEXICO BASINS.
W71-04048 02K

COMPUTER AIDS GROUNDWATER RESOURCES RESEARCH PROJECT,
W71-04057 02F

BUREAU OF RECLAMATION APPROPRIATION ACTS AND ALLOTMENTS 1966 STATISTICAL SUPPLEMENT.
W71-04103 09D

CATALOG OF INFORMATION ON WATER DATA, EDITION 1970 - INDEX TO WATER QUALITY SECTION.
W71-04150 07C

CATALOG OF INFORMATION ON WATER DATA, EDITION 1970-INDEX TO SURFACE WATER SECTION.
W71-04151 07C

DATA STORAGE AND RETRIEVAL
CATALOG OF INFORMATION ON WATER DATA, EDITION 1970 - INDEX TO WATER QUALITY SECTION.
W71-04150 07C

CATALOG OF INFORMATION ON WATER DATA, EDITION 1970-INDEX TO SURFACE WATER SECTION.
W71-04151 07C

DATA TRANSMISSION SYSTEMS
UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME IV. THE FORMATTING AND TRANSMISSION OF DATA FROM OCEANOGRAPHIC SENSORS,
W71-04012 07B

DECISION MAKING
NATURAL RESOURCE SYSTEMS MODELS IN DECISION MAKING.
W71-03855 06A

RESOURCE SYSTEMS MODELS IN DECISION MAKING,
W71-03856 06A

PRIVATE AND SOCIAL COSTING AND PRICING AS DECISION DETERMINANTS,
W71-03863 06C

PRIVATE AND SOCIAL COSTING AS DECISION DETERMINANTS IN WATER RESOURCES,
W71-03864 06B

THE LEGAL SYSTEM STRUCTURE OR CONSTRAINT FOR SYSTEMS ANALYSIS DECISION-MAKING,
W71-03865 06E

CONDITIONS OF LEGAL AND POLITICAL FEASIBILITY,
W71-03866 06E

INTERACTION AMONG NATURAL RESOURCE SYSTEMS, THE DECISION MAKERS AND THE PUBLIC IN THE 2000'S,
W71-03868 06B

APPLICATION OF INDUSTRIAL DYNAMICS CONCEPTS TO DECISION MAKING IN ENVIRONMENTAL MANAGEMENT,
W71-04025 05G

ECONOMIC CONSIDERATIONS IN FACILITY PLANNING,
W71-04285 06B

RULES OF PRACTICE AND PROCEDURE.
W71-04327 06E

DECISION-MAKING
AN ECOLOGICAL CRITERION FOR EVALUATING AN ENVIRONMENT,
W71-04274 06B

POLLUTION PROBLEMS, RESOURCE POLICY AND THE SCIENTIST,
W71-04280 06B

DEGRADATION(STREAM)
SEDIMENT TRANSPORT IN DEGRADING RIVERS,
W71-03995 02J

DELAWARE RIVER
DELAWARE RIVER BASIN COMPACT.
W71-04093 06E

DELAWARE RIVER BASIN COMMISSION
THE DELAWARE RIVER BASIN COMPACT--AN ALTERNATIVE FOR IMPLEMENTING WATER RESOURCES MANAGEMENT (ORGANIZATION, OPERATION, AND RESULTS OF THE BASIN COMPACT),
W71-04089 06E

DELAWARE RIVER BASIN COMPACT.
W71-04093 06E

DELTAS
AN ECONOMIC EVALUATION OF THE WATER QUALITY ASPECTS OF CONTRA COSTA COUNTY'S OFFSHORE WATER SUPPLY.
W71-03909 06B

RADIOMETRIC INVESTIGATIONS ON THE BEACH AT THE MOUTH OF THE KURA RIVER,
W71-03962 02J

DELWARE RIVER BASIN COMMISSION
RULES OF PRACTICE AND PROCEDURE.
W71-04327 06E

DEMINERALIZATION
INDUSTRIAL WASTE DESALTING FOR BYPRODUCT RECOVERY,
W71-04286 05D

DENSITY STRATIFICATION
EFFECT OF DISPERSION, GRAVITATIONAL SEGREGATION, AND FORMATION STRATIFICATION ON THE RECOVERY OF FRESHWATER STORED IN SALINE AQUIFERS,
W71-03870 02F

DENVER(COLO)
STUDY OF MOLYBDENUM IN PUBLIC WATER SUPPLY,
W71-04120 05A

DEPTH-AREA-DURATION ANALYSIS
CALCULATION OF THE MAXIMUM RUNOFF IN FLOODS FROM RAINFALL OVER THE TERRITORIES OF THE UKRAINE AND MOLDAVIA (WITH NO OR INSUFFICIENT HYDROMETRICAL DATA),
W71-03991 02A

METHOD OF ESTIMATING STORM RUNOFF FROM SMALL DRAINAGE BASINS,
W71-03992 02E

A RAPID METHOD OF COMPUTING AREAL RAINFALL,
W71-04123 07B

DESALINATION
SECOND REPORT ON HORIZONTAL-TUBE MULTIPLE-EFFECT PROCESS PILOT PLANT TESTS AND DESIGN,
W71-04220 03A

THE USE OF AMALGAM ELECTRODES TO MEASURE ACTIVITY COEFFICIENTS IN MULTICOMPONENT SALT SOLUTIONS,
W71-04221 01B

FABRICATION OF FELT-MEMBRANE COMPOSITES,
W71-04222 03A

ABSTRACTS OF LITERATURE ON THE DISTILLATION OF SEAWATER AND ON THE USE OF NUCLEAR ENERGY FOR DESALTING.
W71-04226 03A

INDUSTRIAL WASTE DESALTING FOR BYPRODUCT RECOVERY,
W71-04286 05D

DRY LANDS AND A HUNGRY WORLD,
W71-04291 06B

DESALINATION APPARATUS
FABRICATION OF FELT-MEMBRANE COMPOSITES,
W71-04222 03A

REVERSE OSMOSIS DESALTING STATE-OF-THE-ART (1969).
W71-04225 03A

DESALINATION PLANTS
BOLSA ISLAND NUCLEAR POWER AND DESALTING PROJECT FACILITIES (COST AND DESCRIPTION) AND COST OF DESALTED WATER,
W71-03915 03A

DESALINATION PROCESSES
EVALUATION OF THE VERTICAL TUBE EVAPORATOR AND THE MULTISTAGE FLASH DESALINATION PROCESSES.
W71-03913 03A

PROGRESS IN WATER DESALINATION TECHNOLOGY,
W71-04229 03A

DESALTING
ENGINEERING EVALUATION OF FACTORS AFFECTING QUALITY OF WATER SOURCES AVAILABLE FOR SALINE WATER CONVERSION PLANTS,
W71-03916 03A

INDUSTRIAL WASTE DESALTING FOR BYPRODUCT RECOVERY,
W71-04286 05D

DESERTS
SOME ASPECTS OF THE GEOMORPHOLOGY OF THE AIR MOUNTAINS, SOUTHERN SAHARA,
W71-04050 02G

DESIGN CRITERIA
EVALUATION OF THE VERTICAL TUBE EVAPORATOR AND THE MULTISTAGE FLASH DESALINATION PROCESSES.
W71-03913 03A

DESIGN FLOOD
ENVELOPE-FREQUENCY RELATIONS FOR MAXIMUM FLOODS IN MONSOON AREAS OF THE ECAFE REGION.
W71-04117 02B

LECTURE 2 - PROBABLE MAXIMUM PRECIPITATION (PMP) ESTIMATION,
W71-04161 02B

LECTURE 3 - STORM MAXIMIZATION TECHNIQUES IN EQUATORIAL/TROPICAL REGIONS,
W71-04162 02B

LECTURE 4 - ESTIMATION OF PMP AND MAXIMUM FLOODS BY STATISTICAL METHODS,
W71-04163 02B

GARDEN CLUB OF VIRGINIA V VIRGINIA PUBLIC SERVICE CO (JURISDICTION OF CORPORATION COMMISSION TO GRANT PERMIT FOR DAM ON NON-NAVIGABLE RIVER).
W71-04343 06E

DESIGN STANDARDS
1939 RUNOFF INSTRUCTIONS FOR DESIGN OF STORM DRAINS, OFFICE STANDARD NO. 71.
W71-03906 08A

DEUTERIUM
DISTRIBUTION OF HYDROGEN ISOTOPES IN CANADIAN WATERS,
W71-04134 02A

DEUTERIUM MEASUREMENTS ON SNOW SAMPLES FROM THE ALPS,
W71-04136 02A

EXCHANGE OF DEUTERIUM BETWEEN ICE AND WATER IN GLACIOLOGICAL STUDIES IN ICELAND,
W71-04137 02A

QUANTITATIVE ASPECTS OF THE STUDY OF WATER BALANCES IN LAKES USING THE DEUTERIUM AND OXYGEN-18 CONCENTRATIONS IN THE WATER, (FRENCH),
W71-04139 02A

ENVIRONMENTAL ISOTOPE BALANCE OF LAKE TIBERIAS,
W71-04140 02A

STABLE ISOTOPES IN STUDY OF WATER BALANCE OF LAKE NEUSIEDL, AUSTRIA INVESTIGATION OF THE RELIABILITY OF THE STABLE ISOTOPE METHOD,
W71-04141 02A

DEVELOPED WATERS
IRRIGATION DEVELOPMENT IN TUNISIA,
W71-04232 03F

DEVELOPING COUNTRIES
FARMING, FOREST AND SAVANNA IN WESTERN NIGERIA,
W71-04054 03F

NEW APPROACHES TO IRRIGATED FARMING IN THE SUDAN ORGANIZATION AND MANAGEMENT,
W71-04231 03F

IRRIGATION DEVELOPMENT IN TUNISIA,
W71-04232 03F

SPATIAL PATTERNS OF SOCIO-ECONOMIC STRUCTURE IN INDIA,
W71-04234 06B

DRY LANDS AND A HUNGRY WORLD,
W71-04291 06B

DIAGENESIS
A GEOCHEMICAL TREND IN SILICON-ALUMINUM-IRON RATIOS AND THE CLASSIFICATION OF CLASTIC SEDIMENTS,
W71-03945 02K

DIALYSIS
THE STRUCTURE AND MORPHOLOGY OF INORGANIC MEMBRANES,
W71-04224 03A

DIATOMS
A NEW FRESHWATER CENTRIC DIATOM MICROSIPHONA POTAMOS GEN. ET SP. NOV.,
W71-04193 05C

PHYTOPLANKTON, SESTON, AND DISSOLVED ORGANIC CARBON IN THE LITTLE MIAMI RIVER AT CINCINNATI, OHIO,
W71-04209 05A

A GUIDE TO THE COMMON DIATOMS AT WATER POLLUTION SURVEILLANCE SYSTEM STATIONS,

W71-04210 07C

DIELDRIN
PESTICIDES IN SURFACE WATERS OF THE UNITED STATES A FIVE-YEAR SUMMARY 1964-1968,
W71-04201 05A

THE ELECTRON CAPTURE DETECTOR IN THE ANALYSIS OF CHLORINATED HYDROCARBON PESTICIDES IN TISSUES WITH AND WITHOUT CLEAN-UP,
W71-04214 05A

DIFFUSION
THE DIFFUSION OF COPPER, MANGANESE, AND ZINC AS AFFECTED BY CONCENTRATION, CLAY MINERALOGY, AND ASSOCIATED ANIONS,
W71-03942 02G

THE DIFFUSION OF IONS IN UNCONSOLIDATED SEDIMENTS,
W71-03954 02K

DIFFUSIVITY
DENTISTRY PROFESSOR EXPLAINS POLYWATER.
W71-03926 01B

DIGITAL COMPUTERS
COMPUTER AIDS GROUNDWATER RESOURCES RESEARCH PROJECT,
W71-04057 02F

DISCHARGE MEASUREMENT
MEASURING STREAM DISCHARGE USING THE DYE-DILUTION METHOD (CHEMICAL GAUGING),
W71-03930 07B

WATER MEASUREMENT PROCEDURES - IRRIGATION OPERATORS' WORKSHOP.
W71-04007 08B

THE UNIVERSALISATION OF THE CO-ORDINATES OF LOGARITHMIC WEIR PROFILES,
W71-04127 07B

EXPERIMENTAL STUDIES ON LINEAR PROPORTIONAL WEIRS WITH TRIANGULAR BOTTOMS,
W71-04129 08B

DISCHARGE(WATER)
COAL CREEK DRAINAGE AND LEVEE DIST V SANITARY DIST OF CHICAGO (DRAINAGE DISTRICT'S LIABILITY FOR DISCHARGE OF EXCESSIVE WATER INTO RIVER).
W71-04198 06E

THE EFFECT OF VEGETATION CONVERSION AND FLOOD DISCHARGE ON STREAM CHANNEL GEOMETRY THE CASE OF SOUTHERN CALIFORNIA WATERSHEDS,
W71-04230 04D

DISCOUNT RATE
A GUIDE TO USING INTEREST FACTORS IN ECONOMIC ANALYSIS OF WATER PROJECTS,
W71-04283 06B

DISEASE SEVERITY
ELEVATION AND TEMPERATURE EFFECTS ON SEVERITY OF MAIZE DWARF MOSAIC VIRUS IN SORGHUM,
W71-04060 03F

DISSOLVED OXYGEN
SPRAY IRRIGATION OF WASTES FROM THE MANUFACTURE OF HARDBOARD,
W71-03886 05D

DESIGN OF PLUGFLOW POST AERATION BASIN,
W71-03889 05D

BIOLOGICAL CHEMICAL COMBINATION DRAMATICALLY CUTS TREATMENT,
W71-04086 05D

DISSOLVED SOLIDS
BIOLOGICAL CHEMICAL COMBINATION DRAMATICALLY CUTS TREATMENT,
W71-04086 05D

DISTRIBUTED PUMPING
THE PUMPED WELL,
W71-04292 04B

DISTRIBUTION PATTERNS
SUBMARINE VOLCANISM AS A SOURCE FOR IRON,
W71-03955 02K

A CONTRIBUTION TO THE PROBLEM OF SPACING RAINGAUGES IN RUGGED TERRAIN,
W71-04122 07A

A RAPID METHOD OF COMPUTING AREAL RAINFALL,
W71-04123 07B

DEUTERIUM MEASUREMENTS ON SNOW SAMPLES FROM THE ALPS,
W71-04136 02A

ANALYSIS OF RAINFALL OVER A SMALL AREA,
W71-04155 02B

DITCHES
HANOVER DRAINAGE AND LEVEE DIST V SANTA FE DRAINAGE AND LEVEE DIST (DRAINAGE DISTRICT'S AUTHORITY TO REMOVE NATURAL BARRIER AND CHANGE DIRECTION OF DRAINAGE FLOW).
W71-04246 06E

DOCKS
TOWN OF PERU V STATE (COMPENSATION FOR STATE'S APPROPRIATION OF TOWN'S DOCK).
W71-04310 06E

DOCUMENTATION
CATALOG OF INFORMATION ON WATER DATA, EDITION 1970 - INDEX TO WATER QUALITY SECTION.
W71-04150 07C

ABSTRACTS OF LITERATURE ON THE DISTILLATION OF SEAWATER AND ON THE USE OF NUCLEAR ENERGY FOR DESALTING.
W71-04226 03A

DOLOMITE
SOME PROBLEMS OF A KARST AREA IN THE EASTERN TRANSVAAL, SOUTH AFRICA,
W71-04053 02G

DOMESTIC WATER
THE MANAGEMENT OF FORESTED WATERSHEDS FOR DOMESTIC WATER SUPPLIES,
W71-04244 06A

DOUBLE-RING INFILTROMETERS
INFILTRATION IN CONTOUR TRENCHES IN THE SIERRA NEVADA,
W71-04263 04A

DRAINAGE
MOLE DRAINAGE,
W71-04008 08A

DUNBAR V BD OF COMM'RS OF ALBEMARLE DRAINAGE DIST (FAILURE OF DRAINAGE DISTRICT TO ERECT DAM CAUSES CROP FLOODING).
W71-04345 06E

DRAINAGE DISTRICTS
COAL CREEK DRAINAGE AND LEVEE DIST V SANITARY DIST OF CHICAGO (DRAINAGE DISTRICT'S LIABILITY FOR DISCHARGE OF EXCESSIVE WATER INTO RIVER).
W71-04198 06E

HANOVER DRAINAGE AND LEVEE DIST V SANTA FE DRAINAGE AND LEVEE DIST (DRAINAGE DISTRICT'S AUTHORITY TO REMOVE NATURAL BARRIER AND CHANGE DIRECTION OF DRAINAGE FLOW).
W71-04246 06E

DRAINAGE EFFECTS
SOME PROBLEMS OF A KARST AREA IN THE EASTERN TRANSVAAL, SOUTH AFRICA,
W71-04053 02G

DRAINAGE ENGINEERING
1939 RUNOFF INSTRUCTIONS FOR DESIGN OF STORM DRAINS, OFFICE STANDARD NO. 71.
W71-03906 08A

DRAINAGE PRACTICES
1939 RUNOFF INSTRUCTIONS FOR DESIGN OF STORM DRAINS, OFFICE STANDARD NO. 71.
W71-03906 08A

DRAINAGE PROGRAMS
DUCK ISLAND HUNTING AND FISHING CLUB V EDWARD GILLEN DOCK, DREDGE AND CONSTRUCTION CO (DISSOLUTION OF DRAINAGE DISTRICT).
W71-04277 06E

DRAINAGE SYSTEMS
POWER OF CITIES AND TOWNS TO PROVIDE DRAINAGE AND SEWAGE FACILITIES.
W71-04081 06E

DRAWDOWN
GEOHYDROLOGIC BOUNDARY ENVELOPES,
W71-04125 02F

DROUGHTS
SOME ASPECTS OF DROUGHT CLIMATOLOGY OF THE DRY SUBHUMID ZONES OF SOUTH INDIA,
W71-04298 02B

DRYING
THE DEVELOPMENT OF EGGS OF THE RED LOCUST NOMADACRIS SEPTEMFASCIATA (SERV.), AND THE AFRICAN MIGRATORY LOCUST, LOCUSTA MIGRATORIA MIGRATORIODES (R. AND F.), AND ITS INTERRUPTION UNDER PARTICULAR CONDITIONS OF HUMIDITY,
W71-04297 03F

DURATION CURVES
ANALYSIS OF FLOOD DURATION (FRENCH),
W71-03984 02E

DYE RELEASES
MEASURING STREAM DISCHARGE USING THE DYE-DILUTION METHOD (CHEMICAL GAUGING),
W71-03930 07B

A MECHANICAL DEVICE FOR RELEASING FLUORESCENT TRACERS,
W71-03949 07B

DYE-DILUTION METHOD
MEASURING STREAM DISCHARGE USING THE DYE-DILUTION METHOD (CHEMICAL GAUGING),
W71-03930 07B

DYNAMIC PROGRAMMING
SYSTEM OPTIMIZATION FOR RIVER BASIN WATER QUALITY MANAGEMENT,
W71-03881 05G

OPTIMAL ALLOCATION OF STOCHASTIC WATER SUPPLY,
W71-04028 03B

AN APPROACH TO FINDING RESERVOIR RULES FOR POWER

OPTIMIZATION,
W71-04037 04A

MODELING AND OPTIMIZATION OF WATER RESOURCES SYSTEMS - PHASE I,
W71-04043 06A

OPTIMUM FIRE POWER OUTPUT FROM A TWO RESERVOIR SYSTEM BY INCREMENTAL DYNAMIC PROGRAMMING,
W71-04111 04A

DYNAMICS
APPLICATION OF INDUSTRIAL DYNAMICS CONCEPTS TO DECISION MAKING IN ENVIRONMENTAL MANAGEMENT,
W71-04025 05G

EARTHQUAKES
OPTIMIZATION OF WATER RESOURCE SYSTEMS INCORPORATING EARTHQUAKE RISK PROGRESS REPORT NO 1,
W71-04041 06A

EARTH(PLANET)
THE WORLD OF WATER,
W71-04118 02A

EASEMENTS
MANNING V METROPOLITAN DISTRICT COMM'N (CONSTITUTIONALITY OF ACT AUTHORIZING CONDEMNATION FOR DRAINAGE).
W71-04279 06E

SCANLAN V HOPKINS (LEGAL CONSEQUENCES OF AGREEMENT BY GRANTOR TO CONSTRUCT CULVERT OVER NATURAL WATERCOURSE).
W71-04314 06E

EAST AFRICA
AGROMETEOROLOGY SURVEY OF THE HIGHLANDS OF EASTERN AFRICA,
W71-04062 02D

ECAFE
ENVELOPE-FREQUENCY RELATIONS FOR MAXIMUM FLOODS IN MONSOON AREAS OF THE ECAFE REGION.
W71-04117 02B

QUANTITATIVE REGIONAL PREDICTION OF RAINFALL IN ECAFE REGIONS,
W71-04152 02B

VERTICAL VELOCITY AND RAINFALL COMPUTATION,
W71-04153 02B

DETECTION OF PRECIPITATION BY RADAR,
W71-04154 07B

ANALYSIS OF RAINFALL OVER A SMALL AREA,
W71-04155 02B

RAIN FROM TROPICAL CYCLONES AND TROUGH-TYPE SYSTEMS,
W71-04156 02B

ANALYSIS OF MESOSCALE SYSTEMS,
W71-04157 02B

SURVEY OF OBJECTIVE METHODS USED IN HONG KONG FOR PREDICTING TYPHOON MOVEMENT,
W71-04158 02B

PREDICTION OF FLOODS FROM HEAVY RAINFALL,
W71-04159 02E

LECTURE 1 - FACTORS INFLUENCING RAINFALL FORMATION AND DISTRIBUTION,
W71-04160 02B

LECTURE 2 - PROBABLE MAXIMUM PRECIPITATION (PMP) ESTIMATION,
W71-04161 02B

LECTURE 3 - STORM MAXIMIZATION TECHNIQUES IN EQUATORIAL/TROPICAL REGIONS,
W71-04162 02B

LECTURE 4 - ESTIMATION OF PMP AND MAXIMUM FLOODS BY STATISTICAL METHODS,
W71-04163 02B

SEVERE CYCLONIC STORM RESPONSIBLE FOR FLASH FLOOD IN PAKOKKU AND MONYWA DISTRICTS DURING THE MONTH OF OCTOBER 1967,
W71-04164 02B

LOWER AND MIDDLE IRRAWADDY FLOODS IN RELATION TO HEAVY RAINFALL IN THE HEAD WATER REGIONS OF CHINDWIN AND IRRAWADDY RIVERS,
W71-04165 02E

SOME EXAMPLES OF HEAVY RAINFALL IN JAPAN,
W71-04166 02B

THE PROBLEM OF FLOOD PREDICTION ON THE EAST COAST OF WEST MALAYSIA,
W71-04167 02B

HEAVY RAINFALL IN PAKISTAN AND ITS ASSOCIATED FLOOD,
W71-04168 02B

HEAVY RAINFALL AND ASSOCIATED FLOODS IN WEST PAKISTAN,
W71-04169 02B

THE CIRCULATION PATTERN OVER SINGAPORE AND THE EAST COAST OF WEST MALAYSIA DURING JANUARY AND FEBRUARY 1967 COMPARED WITH THAT OF JANUARY AND FEBRUARY 1968,
W71-04170 02B

ECOLOGY
NATURE'S LAW AND MAN'S ETHIC,
W71-04069 04C

ECOLOGICAL SIGNIFICANCE OF ALIEN PLANTS IN CALIFORNIA GRASSLANDS,
W71-04233 04A

ECONOMIC EFFICIENCY
PRIVATE AND SOCIAL COSTING AND PRICING AS DECISION DETERMINANTS,
W71-03863 06C

ASPECTS OF THE SOUTH AUSTRALIAN CITRUS INDUSTRY,
W71-04051 03F

NEW APPROACHES TO IRRIGATED FARMING IN THE SUDAN ORGANIZATION AND MANAGEMENT,
W71-04231 03F

IRRIGATION AS A FARM GROWTH STRATEGY,
W71-04290 03F

ECONOMIC FEASIBILITY
FARMING, FOREST AND SAVANNA IN WESTERN NIGERIA,
W71-04054 03F

FEEDING A DESERT CITY ANTOFAGASTA, CHILE,
W71-04055 03F

ECONOMIC GROWTH
IRRIGATION AS A FARM GROWTH STRATEGY,
W71-04290 03F

ECONOMIC IMPACT
THE IMPACT OF AGRICULTURAL CHANGE ON A LOCAL ECONOMY IN THE GREAT PLAINS,
W71-04289 03F

ECONOMIC JUSTIFICATION
ALTERNATIVE CROP ENTERPRISE BUDGETS FOR IRRIGATED PRODUCTION, SOUTHWESTERN OKLAHOMA,
W71-04294 03F

ECONOMIC PREDICTION
AN ECONOMIC EVALUATION OF THE WATER QUALITY ASPECTS OF CONTRA COSTA COUNTY'S OFFSHORE WATER SUPPLY.
W71-03909 06B

THE ECONOMIC IMPACT OF ALTERNATIVE WATER CONDITIONS, A REPORT TO THE CONTRA COSTA COUNTY WATER AGENCY.
W71-03910 06B

ALTERNATIVE CROP ENTERPRISE BUDGETS FOR IRRIGATED PRODUCTION, SOUTHWESTERN OKLAHOMA,
W71-04294 03F

ECONOMIC SURVIVAL
IRRIGATION AS A FARM GROWTH STRATEGY,
W71-04290 03F

ECONOMICS
NATURAL RESOURCE SYSTEMS MODELS IN DECISION MAKING.
W71-03855 06A

PRIVATE AND SOCIAL COSTING AS DECISION DETERMINANTS IN WATER RESOURCES,
W71-03864 06B

OPTIMAL OPERATION OF WATER SUPPLY SYSTEMS,
W71-04042 04B

ECONOMICS OF THERMAL POLLUTION CONTROL,
W71-04084 05D

ECONOMIC CONSIDERATIONS IN FACILITY PLANNING,
W71-04285 06B

ECONOMIES OF SCALE
DESIGN CAPACITIES TO ACCOMMODATE FORECAST UNDERTAINTIES,
W71-04026 06A

ECORSE RIVER
ECORSE RIVER WATER QUALITY STUDY, MAY-JULY, 1969.
W71-03907 05B

EGYPT
FORMATION OF PHYTOGENIC HILLOCKS II. ROOTING HABIT OF PLANTS FORMING PHYTOGENIC HILLOCKS,
W71-04295 02I

ROOT DEVELOPMENT OF TWO COMMON SPECIES IN DIFFERENT HABITATS IN THE MEDITERRANEAN SUBREGION IN EGYPT,
W71-04300 02I

ELECTRICAL WELL LOGGING
NEW CHART OFFERS FAST PERMEABILITY ESTIMATE,
W71-04110 07B

ELECTRODES
THE USE OF AMALGAM ELECTRODES TO MEASURE ACTIVITY COEFFICIENTS IN MULTICOMPONENT SALT SOLUTIONS,
W71-04221 01B

ELECTROLYTES
THEORETICAL MEAN ACTIVITY COEFFICIENTS OF STRONG ELECTROLYTES IN AQUEOUS SOLUTIONS FROM 0 TO 100 DEG C,
W71-04183 01B

ELECTRON CAPTURE DETECTOR
THE ELECTRON CAPTURE DETECTOR IN THE ANALYSIS OF CHLORINATED

HYDROCARBON PESTICIDES IN TISSUES WITH AND WITHOUT CLEAN-UP,
W71-04214 05A

ELECTRON CAPTURE GAS CHROMATOGRAPHY
MICRODETERMINATION OF DERIVATIVES OF PHENOLS AND MERCAPTANS BY MEANS OF ELECTRON CAPTURE GAS CHROMATOGRAPHY,
W71-04218 05A

ELECTRON MICROSCOPY
USE OF PORE CASTS AND SCANNING ELECTRON MICROSCOPE TO STUDY PORE GEOMETRY,
W71-03946 07B

ELEVATION
ELEVATION AND TEMPERATURE EFFECTS ON SEVERITY OF MAIZE DWARF MOSAIC VIRUS IN SORGHUM,
W71-04060 03F

EMBRYONIC GROWTH STAGE
THE DEVELOPMENT OF EGGS OF THE RED LOCUST NOMADACRIS SEPTEMFASCIATA (SERV.), AND THE AFRICAN MIGRATORY LOCUST, LOCUSTA MIGRATORIA MIGRATORIODES (R. AND F.), AND ITS INTERRUPTION UNDER PARTICULAR CONDITIONS OF HUMIDITY,
W71-04297 03F

EMINENT DOMAIN
THE DOCTRINE OF CONSEQUENTIAL LOSS AS AFFECTED BY VALUATION FORMULAS,
W71-04031 06E

TOWN OF PERU V STATE (COMPENSATION FOR STATE'S APPROPRIATION OF TOWN'S DOCK).
W71-04310 06E

IN RE WATERFRONT OF CITY OF NEW YORK (RIPARIAN RIGHTS SUBJECT TO PUBLIC RIGHT TO IMPROVE NAVIGATION).
W71-04323 06E

HALEY V DAVENPORT (CONSTITUTIONALITY OF STATUTE AUTHORIZING TRESPASS TO DRAIN SWAMPS AND PONDS).
W71-04341 06E

ENCROACHMENT
AN ECONOMIC EVALUATION OF THE WATER QUALITY ASPECTS OF CONTRA COSTA COUNTY'S OFFSHORE WATER SUPPLY.
W71-03909 06B

THE ECONOMIC IMPACT OF ALTERNATIVE WATER CONDITIONS, A REPORT TO THE CONTRA COSTA COUNTY WATER AGENCY.
W71-03910 06B

ENERGY BUDGET
PREDICTION OF SOLAR AND ATMOSPHERIC RADIATION FOR ENERGY BUDGET STUDIES OF LAKES AND STREAMS,
W71-04020 02B

SOME RESULTS OF INVESTIGATION AND REPRESENTATION OF SNOW SUPPLY AND THE MELTING OF SNOW,
W71-04174 02C

ENGINEERING
WATER RESOURCES SYSTEMS ENGINEERING,
W71-03885 06A

ENGLAND
WATER MOVEMENT IN THE UNSATURATED ZONE OF HIGH AND LOW PERMEABILITY STRATA BY MEASURING NATURAL TRITIUM,
W71-04138 02A

THE INSTITUTIONAL FRAMEWORK FOR WATER MANAGEMENT IN ENGLAND AND WALES,
W71-04282 06E

ENHANCED SURFACE TUBES
EVALUATION OF THE VERTICAL TUBE EVAPORATOR AND THE MULTISTAGE FLASH DESALINATION PROCESSES.
W71-03913 03A

ENVELOPES(MATHEMATICAL)
GEOHYDROLOGIC BOUNDARY ENVELOPES,
W71-04125 02F

ENVIRONMENT
A NATIONAL POLICY FOR THE ENVIRONMENT SELECTED EXCERPTS FROM THE CONGRESSIONAL RECORD AND CONGRESSIONAL DOCUMENTS, FALL, 1969, 91ST CONGRESS. 1ST SESSION.
W71-04092 06E

REORGANIZATION PLAN NO. 3 OF 1970 (ENVIRONMENTAL PROTECTION AGENCY).
W71-04325 06E

REORGANIZATION PLANS NOS. 3 AND 4 OF 1970.
W71-04326 06E

ENVIRONMENTAL EFFECTS
AN ECOLOGICAL CRITERION FOR EVALUATING AN ENVIRONMENT,
W71-04274 06B

INFLUENCE OF MANAGEMENT AND ENVIRONMENTAL FACTORS ON EXTENT OF SOIL WATER DEPLETION BY SPRING WHEAT,
W71-04303 03F

ENVIRONMENTAL ENGINEERING
NATURE'S LAW AND MAN'S ETHIC,
W71-04069 04C

ENVIRONMENTAL MANAGEMENT
INTERACTION AMONG NATURAL RESOURCE SYSTEMS, THE DECISION MAKERS AND THE PUBLIC IN THE 2000'S,
W71-03868 06B

EPIDEMICS
WIESNER V CITY OF ALBANY (MUNICIPAL LIABILITY FOR TYPHOID EPIDEMIC CAUSED BY DEFECTIVE PIPELINE).
W71-04322 06E

EROSION
TECHNOLOGY FOR SEDIMENT CONTROL IN URBAN AREAS,
W71-04148 04D

THE CONTROL OF EROSION AND SEDIMENT IN HIGHWAY CONSTRUCTION,
W71-04149 04D

INFILTRATION AND SOIL EROSION AS INFLUENCED BY VEGETATION AND SOIL IN NORTHERN UTAH,
W71-04260 02J

INFILTRATION AND SOIL EROSION ON COOLWATER RIDGE, IDAHO,
W71-04261 02J

EROSION CONTROL
GREAT LAKES SHORELAND MANAGEMENT AND EROSION DAMAGE CONTROL FOR MICHIGAN.
W71-03908 02H

AN OVERVIEW OF U.S. DEPARTMENT OF INTERIOR'S ROLE IN SEDIMENT CONTROL,
W71-04147 04D

TECHNOLOGY FOR SEDIMENT CONTROL IN URBAN AREAS,
W71-04148 04D

THE CONTROL OF EROSION AND SEDIMENT IN HIGHWAY CONSTRUCTION,
W71-04149 04D

FOURWING SALTBUSH CAN BE FIELD PLANTED SUCCESSFULLY,
W71-04247 04A

EROSION CONTROL MEASURES
TECHNOLOGY FOR SEDIMENT CONTROL IN URBAN AREAS,
W71-04148 04D

ESTIMATING
PROBLEM OF THE CLASSIFICATION AND SPATIAL VARIABILITY OF THE ALBEDO OF A HOMOGENEOUS GLACIER SURFACE DURING THE ABLATION PERIOD,
W71-03971 02C

EVALUATION OF MAXIMUM RAINFALL DISCHARGE FROM A REGION OF DEFICIENT RAINFALL DATA,
W71-03978 02E

THE CALCULATION OF RAINFALL FROM A HURRICANE,
W71-03993 02B

ESTIMATING EQUATIONS
SPATIAL PATTERNS OF SOCIO-ECONOMIC STRUCTURE IN INDIA,
W71-04234 06B

ESTUARIES
WATER QUALITY - BENTHIC INVERTEBRATE RELATIONSHIPS IN ESTUARIES,
W71-03922 05C

THE PERIODIC CYCLE OF PARTICULATE MATTER IN A SHALLOW, TEMPERATE ESTUARY,
W71-03943 02L

COST OF PATUXENT RIVER QUALITY MONITORING,
W71-04115 05A

CHESAPEAKE BAY IN LEGAL PERSPECTIVE,
W71-04337 06E

ETHERS
MICRODETERMINATION OF DERIVATIVES OF PHENOLS AND MERCAPTANS BY MEANS OF ELECTRON CAPTURE GAS CHROMATOGRAPHY,
W71-04218 05A

EUTROPHICATION
THE ROLE OF AQUATIC VASCULAR PLANTS IN THE EUTROPHICATION OF SELECTED LAKES IN WASTERN MASSACHUSETTS,
W71-03918 05C

BIODEGRADABILITY OF POTENTIAL ORGANIC SUBSTITUTES FOR PHOSPHATES,
W71-04072 05D

ACCUMULATION OF PHOSPHATES IN WATER,
W71-04216 05B

EVALUATION
INCORPORATING SOCIAL OBJECTIVES IN SYSTEMS MODELS,
W71-03862 06B

AN ECONOMIC EVALUATION OF THE WATER QUALITY ASPECTS OF CONTRA COSTA COUNTY'S OFFSHORE WATER SUPPLY.
W71-03909 06B

THE ECONOMIC IMPACT OF ALTERNATIVE WATER CONDITIONS, A REPORT TO THE CONTRA COSTA COUNTY WATER AGENCY.
W71-03910 06B

COMMENTS ON 'THE LINEAR DECISION RULE IN RESERVOIR MANAGEMENT AND DECISION RULE IN RESERVOIR MANAGEMENT AND DESIGN' BY CHARLES REVELLE, ERHARD JOERES AND WILLIAM KIRBY,
W71-04029 06B

THE ROLE OF ECONOMIC EVALUATION IN GOVERNMENTAL ANALYSIS,
W71-04272 06B

EVALUATION OF INTANGIBLES,
W71-04273 06B

USING COMPUTERS TO HELP EVALUATE FLOOD PROTECTION MEASURES,
W71-04293 07C

EVALUATION OF IRRIGATION WATER AND NITROGEN FERTILIZER IN CORN PRODUCTION,
W71-04304 03F

EVAPORATION
IMPROVING EFFICIENCY IN AGRICULTURAL WATER USE,
W71-04049 03C

PERCH LAKE EVAPORATION STUDY,
W71-04142 02A

SECULAR VARIATION OF ARIDITY IN THE WORLD,
W71-04288 02A

EVAPOTRANSPIRATION
INFLUENCE OF LOW RATES OF WATER APPLICATION BY SPRINKLERS ON THE MICROCLIMATE,
W71-03925 02D

AGROMETEOROLOGY SURVEY OF THE HIGHLANDS OF EASTERN AFRICA,
W71-04062 02D

POTENTIAL EVAPOTRANSPIRATION AND THE WATER BALANCE IN WEST AFRICA AN ALTERNATIVE METHOD OF PENMAN,
W71-04063 02D

PROBLEMS OF DETERMINING EVAPOTRANSPIRATION IN THE SEMI-ARID TROPICS ILLUSTRATED WITH REFERENCE TO THE SUDAN,
W71-04236 02D

SOIL MOISTURE DEPLETION AND ESTIMATED EVAPOTRANSPIRATION ON UTAH MOUNTAIN WATERSHED,
W71-04242 02D

EVAPOTRANSPIRATION CONTROL
ASPEN SPROUT PRODUCTION AND WATER USE,
W71-04241 02I

SOIL MOISTURE DEPLETION AND ESTIMATED EVAPOTRANSPIRATION ON UTAH MOUNTAIN WATERSHED,
W71-04242 02D

EXPERIMENTAL WATERSHEDS
INCREASES IN WATER YIELD FOLLOWING CLEAR-CUT LOGGING IN THE PACIFIC NORTHWEST,
W71-04240 03B

EXTERNALITIES
PRIVATE AND SOCIAL COSTING AS DECISION DETERMINANTS IN WATER RESOURCES,
W71-03864 06B

FARM MANAGEMENT
FARMING, FOREST AND SAVANNA IN WESTERN NIGERIA,
W71-04054 03F

IRRIGATION AS A FARM GROWTH STRATEGY,
W71-04290 03F

FARM WASTES
MOVEMENT OF AGRICULTURAL POLLUTANTS WITH GROUNDWATER,
W71-04121 05B

FEASIBILITY
CONDITIONS OF LEGAL AND POLITICAL FEASIBILITY,
W71-03866 06E

FEDERAL GOVERNMENT
A NATIONAL POLICY FOR THE ENVIRONMENT SELECTED EXCERPTS FROM THE CONGRESSIONAL RECORD AND CONGRESSIONAL DOCUMENTS, FALL, 1969, 91ST CONGRESS. 1ST SESSION.
W71-04092 06E

FEDERAL WATER RESOURCES RESEARCH ACTIVITIES.
W71-04105 06E

HEARINGS BEFORE THE SUBCOMMITTEE ON FLOOD CONTROL - RIVERS AND HARBORS THE COMMITTEE ON PUBLIC WORKS, UNITED STATES SENATE, 90TH CONGRESS, 2ND SESSION.
W71-04255 06E

FEDERAL WATER-POWER LEGISLATION,
W71-04307 06E

REORGANIZATION PLAN NO. 3 OF 1970 (ENVIRONMENTAL PROTECTION AGENCY).
W71-04325 06E

REORGANIZATION PLANS NOS. 3 AND 4 OF 1970.
W71-04326 06E

FEDERAL JURISDICTION
ENVIRONMENTAL JURISDICTION IN THE CONGRESS AND THE EXECUTIVE,
W71-04106 06E

FEDERAL POWER ACT
FEDERAL WATER-POWER LEGISLATION,
W71-04307 06E

FEDERAL PROJECT POLICY
A NATIONAL POLICY FOR THE ENVIRONMENT SELECTED EXCERPTS FROM THE CONGRESSIONAL RECORD AND CONGRESSIONAL DOCUMENTS, FALL, 1969, 91ST CONGRESS. 1ST SESSION.
W71-04092 06E

THE LAND AND WATER CONSERVATION FUND ACT DEVELOPMENT AND IMPACT,
W71-04097 06E

HEARINGS BEFORE THE SUBCOMMITTEE ON FLOOD CONTROL - RIVERS AND HARBORS THE COMMITTEE ON PUBLIC WORKS, UNITED STATES SENATE, 90TH CONGRESS, 2ND SESSION.
W71-04255 06E

FEDERAL RECLAMATION LAW
BUREAU OF RECLAMATION APPROPRIATION ACTS AND ALLOTMENTS 1966 STATISTICAL SUPPLEMENT.
W71-04103 09D

RECLAMATION IN THE UNITED STATES,
W71-04306 06C

BUREAU OF RECLAMATION APPROPRIATION ACTS AND ALLOTMENTS.
W71-04309 09D

FEDERAL WATER POLLUTION CONTROL ACT
ACTIVITIES OF THE FEDERAL WATER POLLUTION CONTROL ADMINISTRATION--WATER QUALITY STANDARDS.
W71-04096 06E

FELT-MEMBRANE COMPOSITES
FABRICATION OF FELT-MEMBRANE COMPOSITES,
W71-04222 03A

FERROMAGNESIAN MINERALS
ADSORPTION OF BORON BY FERROMAGNESIAN MINERALS AND MAGNESIUM HYDROXIDE,
W71-03939 02G

FERTILIZERS
EVALUATION OF IRRIGATION WATER AND NITROGEN FERTILIZER IN CORN PRODUCTION,
W71-04304 03F

FILTRATION
WASTE PROBLEMS RELATIVE TO MINING AND MILLING OF MOLYBDENUM,
W71-03888 05D

THE ANAEROBIC FILTER FOR WASTE TREATMENT,
W71-04075 05D

HIGH-RATE BIOFILTRATION PAST AND FUTURE,
W71-04076 05D

KINETICS OF FIXED FILM BIOLOGICAL REACTORS,
W71-04085 05D

SOLIDS SEPARATION BY ULTRAFILTRATION FOR CONCENTRATED ACTIVATED SLUDGE,
W71-04087 05D

FISH
STUDY OF WATER POLLUTION PROBLEMS WHICH AFFECT FISH AND OTHER AQUATIC FORMS,
W71-03852 05C

FISH HARVEST
THE EVALUATION OF ENVIRONMENTAL ALTERATION BY THERMAL LOADING AND ACID POLLUTION IN THE COOLING RESERVOIR OF A STEAM-ELECTRIC STATION,
W71-04019 05C

FISH REPRODUCTION
THE EVALUATION OF ENVIRONMENTAL ALTERATION BY THERMAL LOADING AND ACID POLLUTION IN THE COOLING RESERVOIR OF A STEAM-ELECTRIC STATION,
W71-04019 05C

FISHES
THE EFFECT OF SOME SOLVENTS ON LOWER WATER ANIMALS AND ON FISHES,
W71-03854 05C

FLAMING GORGE RESERVOIR(UTAH AND WYO
WATER-QUALITY DATA FOR THE FLAMING GORGE RESERVOIR AREA, UTAH AND WYOMING,
W71-03936 07C

FLASH DISTILLATION
EVALUATION OF THE VERTICAL TUBE EVAPORATOR AND THE MULTISTAGE FLASH DESALINATION PROCESSES.
W71-03913 03A

BOLSA ISLAND NUCLEAR POWER AND DESALTING PROJECT FACILITIES (COST AND DESCRIPTION) AND COST OF DESALTED WATER,
W71-03915 03A

FLASH FLOODS
CHARACTERISTICS OF THE CONSTRUCTION OF EQUALLY PROBABLE FLASH FLOOD HYDROGRAPHS,
W71-03976 02E

SEVERE CYCLONIC STORM RESPONSIBLE FOR FLASH FLOOD IN PAKOKKU AND MONYWA DISTRICTS DURING THE MONTH OF OCTOBER 1967,
W71-04164 02B

FLOOD CONTROL
MUD FLOWS AND FLOODS AND THEIR CONTROL,
W71-03970 02J

DO CONTOUR TRENCHES REDUCE WET-MANTLE FLOOD PEAKS,
W71-04262 04A

FLOOD DAMAGE
GREAT LAKES SHORELAND MANAGEMENT AND EROSION DAMAGE CONTROL

FOR MICHIGAN.
W71-03908 02H

FLOOD PLAIN INFORMATION, KIRBY CREEK, GRAND PRAIRIE, TEXAS.
W71-04143 04A

FLOOD PLAIN INFORMATION, TRUCKEE RIVER, RENO-SPARKS-TRUCKEE MEADOWS, NEVADA.
W71-04144 04A

FLOOD PLAIN INFORMATION, BURCH CREEK, OGDEN, UTAH.
W71-04145 04A

DUNBAR V BD OF COMM'RS OF ALBEMARLE DRAINAGE DIST (FAILURE OF DRAINAGE DISTRICT TO ERECT DAM CAUSES CROP FLOODING).
W71-04345 06E

FLOOD FORECASTING
WATER DISCHARGE TRAVEL TIME COEFFICIENTS,
W71-03973 02E

CHARACTERISTICS OF THE CONSTRUCTION OF EQUALLY PROBABLE FLASH FLOOD HYDROGRAPHS,
W71-03976 02E

DETERMINATION OF THE DISTRIBUTION OF RAINFALL FLOODS IN LARGE CATCHMENTS USING HYDROMETEOROLOGICAL DATA,
W71-03977 02E

EVALUATION OF MAXIMUM RAINFALL DISCHARGE FROM A REGION OF DEFICIENT RAINFALL DATA,
W71-03978 02E

DETERMINATION OF MAXIMUM FLOOD FLOW AND THE PROBABILITY OF ITS BEING EXCEEDED, USING INCOMPLETE INFORMATION (FRENCH),
W71-03979 02E

ANALYSIS OF THE RELATION BETWEEN PRECIPITATION AND FLOOD FLOW WITH THE AID OF A TRIPLE TRANSFORMATION BASED ON THE UNIT HYDROGRAPH METHOD (FRENCH),
W71-03980 02A

COMPUTATION OF MAXIMUM STORM DISCHARGE OF MOUNTAIN RIVERS,
W71-03982 02A

EVALUATION OF MAXIMUM FLOW OF FLOODS USING PRECIPITATION DATA (FRENCH),
W71-03983 02A

ANALYSIS OF FLOOD DURATION (FRENCH),
W71-03984 02E

DETERMINATION OF MAXIMUM FLOW AND FLOOD HYDROGRAPHS (FRENCH),
W71-03985 02E

PROBABLE FLOOD DISCHARGES OF THE PO RIVER TRIBUTARIES,
W71-03987 02E

FORMATION OF RAINFALL FLOODS ON SMALL WATERSHEDS. PRINCIPLES OF MAXIMUM STORM RUNOFF COMPUTATION,
W71-03988 02A

PRACTICAL METHODS OF ESTIMATING MAXIMUM FLOODS (FRENCH),
W71-03990 02E

ENVELOPE-FREQUENCY RELATIONS FOR MAXIMUM FLOODS IN MONSOON AREAS OF THE ECAFE REGION.
W71-04117 02B

PREDICTION OF FLOODS FROM HEAVY RAINFALL,
W71-04159 02E

LOWER AND MIDDLE IRRAWADDY FLOODS IN RELATION TO HEAVY RAINFALL IN THE HEAD WATER REGIONS OF CHINDWIN AND IRRAWADDY RIVERS,
W71-04165 02E

SNOWMELT AND WATER YIELD FROM SNOW COVER,
W71-04171 02C

CALCULATION OF FLOOD WAVES FOR A LARGE RIVER SYSTEM,
W71-04176 02E

METHODS OF SNOWMELT MAXIMUM DISCHARGE COMPUTATION IN CASES OF ABSENCE OR INSUFFICIENCY OF HYDROMETRIC DATA,
W71-04177 02C

A METHOD FOR THE CALCULATION OF SPRING FLOODS,
W71-04178 02E

FLOOD PLAIN ZONING
ESTABLISHING AN ENGINEERING BASIS FOR FLOOD PLAIN REGULATIONS,
W71-04270 04A

FLOOD PLAINS
INFLUENCE OF THE BANKS AND FLOOD PLAIN ON CHANNEL CONVEYANCE,
W71-03968 02E

FLOOD PLAIN INFORMATION, KIRBY CREEK, GRAND PRAIRIE, TEXAS.
W71-04143 04A

FLOOD PLAIN INFORMATION, TRUCKEE RIVER, RENO-SPARKS-TRUCKEE MEADOWS, NEVADA.
W71-04144 04A

FLOOD PLAIN INFORMATION, BURCH CREEK, OGDEN, UTAH.
W71-04145 04A

FOURWING SALTBUSH CAN BE FIELD PLANTED SUCCESSFULLY,
W71-04247 04A

FLOOD PROTECTION
DO CONTOUR TRENCHES REDUCE WET-MANTLE FLOOD PEAKS,
W71-04262 04A

ESTABLISHING AN ENGINEERING BASIS FOR FLOOD PLAIN REGULATIONS,
W71-04270 04A

USING COMPUTERS TO HELP EVALUATE FLOOD PROTECTION MEASURES,
W71-04293 07C

FLOOD ROUTING
PREDICTION OF FLOODS FROM HEAVY RAINFALL,
W71-04159 02E

FLOODS
FLOOD PROFILE STUDY, HOOSIER CREEK, LINN COUNTY, IOWA,
W71-03932 02E

SOME ASPECTS OF THE FORMATION OF MUDFLOWS AND METHODS OF COMPUTING THEM,
W71-03963 02J

INFLUENCE OF THE BANKS AND FLOOD PLAIN ON CHANNEL CONVEYANCE,
W71-03968 02E

MAXIMUM DISCHARGE OF MAJOR RIVERS IN LARGE FLOOD PLAINS IN EAST PAKISTAN,
W71-03986 02E

FLOOD PLAIN INFORMATION, KIRBY CREEK, GRAND PRAIRIE, TEXAS.
W71-04143 04A

FLOOD PLAIN INFORMATION, TRUCKEE RIVER, RENO-SPARKS-TRUCKEE MEADOWS, NEVADA.
W71-04144 04A

FLOOD PLAIN INFORMATION, BURCH CREEK, OGDEN, UTAH.
W71-04145 04A

SEVERE CYCLONIC STORM RESPONSIBLE FOR FLASH FLOOD IN PAKOKKU AND MONYWA DISTRICTS DURING THE MONTH OF OCTOBER 1967,
W71-04164 02B

LOWER AND MIDDLE IRRAWADDY FLOODS IN RELATION TO HEAVY RAINFALL IN THE HEAD WATER REGIONS OF CHINDWIN AND IRRAWADDY RIVERS,
W71-04165 02E

RUNOFF CONDITIONS DURING SNOW THAWING IN THE MORAVIAN-SILESIAN BESKIDS,
W71-04175 02C

ANALYSIS OF SNOW MELT FLOODS,
W71-04179 02E

CHICK SPRINGS WATER CO V STATE HIGHWAY DEP'T (STATE'S LIABILITY FOR INVERSE CONDEMNATION WHEN INADEQUATE CULVERT CAUSES FLOODING).
W71-04197 06E

LAND DEVELOPMENT, INC V LOUISVILLE GAS AND ELECTRIC CO (LIABILITY FOR FAULTY CONSTRUCTION OF CULVERT DIVERTING STREAM).
W71-04312 06E

FLORIDA
RECOMMENDATIONS CONCERNING PROPOSED LEGISLATION TO AUTHORIZE WATER MANAGEMENT DISTRICTS IN FLORIDA.
W71-03878 06E

FLORIDA STRAITS
MINERAL AND CHEMICAL COMPOSITION OF SEDIMENTS FROM THE STRAITS OF FLORIDA,
W71-03944 02J

FLOTATION
WASTE PROBLEMS RELATIVE TO MINING AND MILLING OF MOLYBDENUM,
W71-03888 05D

FLOW
ECONOMICS OF THERMAL POLLUTION CONTROL,
W71-04084 05D

FLOW RESISTANCE
SATURATION-UNSATURATION TRANSITION IN INFILTRATION TO A NON-UNIFORM SOIL PROFILE,
W71-04066 02G

FLUVIC ACID
LIMNOLOGICAL FEATURES OF A NORTHERN BROWN-WATER STREAM, WITH SPECIAL REFERENCES TO THE LIFE HISTORIES OF THE AQUATIC INSECTS,
W71-04215 05C

FOAM SEPARATION
TREATMENT OF ACID MINE DRAINAGE BY FOAM SEPARATION,
W71-04188 05D

FOOD ABUNDANCE
FEEDING A DESERT CITY ANTOFAGASTA, CHILE,
W71-04055 03F

FORAGES
FOURWING SALTBUSH CAN BE FIELD PLANTED SUCCESSFULLY,
W71-04247 04A

AN ECONOMIC ANALYSIS OF LEVEL BENCH SYSTEMS FOR FORAGE PRODUCTION IN NORTH DAKOTA,
W71-04265 03F

FORECASTING
DESIGN CAPACITIES TO ACCOMMODATE FORECAST UNDERTAINTIES,
W71-04026 06A

FOREST FIRES
WETTING AGENT FAILS TO CURB EROSION FROM BURNED WATERSHED,
W71-04250 04D

FORESTS
FARMING, FOREST AND SAVANNA IN WESTERN NIGERIA,
W71-04054 03F

FORMALIN
THE PRESERVATION OF PHYTOPLANKTON GRAB SAMPLES,
W71-04207 05A

FORMS
SARATOV HYDROELECTRIC POWERPLANT CONSTRUCTION DATA,
W71-04017 08C

FREEZING
INVESTIGATION OF THE WATER REGIME OF SOILS IN THE AERATION ZONE, THEIR FREEZING, WATER-PHYSICAL AND FILTRATION PROPERTIES,
W71-03964 02G

SOIL FREEZING DETERMINED WITH FOUR TYPES OF WATER-FILLED TUBES,
W71-04251 07B

FREQUENCY ANALYSIS
DETERMINATION OF MAXIMUM FLOOD FLOW AND THE PROBABILITY OF ITS BEING EXCEEDED, USING INCOMPLETE INFORMATION (FRENCH),
W71-03979 02E

COMPUTATION OF MAXIMUM STORM DISCHARGE OF MOUNTAIN RIVERS,
W71-03982 02A

ANALYSIS OF FLOOD DURATION (FRENCH),
W71-03984 02E

ENVELOPE-FREQUENCY RELATIONS FOR MAXIMUM FLOODS IN MONSOON AREAS OF THE ECAFE REGION.
W71-04117 02B

FRESH WATER
FWPCA METHODS FOR CHEMICAL ANALSIS OF WATER AND WASTES.
W71-04202 05A

FUNGAL-BOUND RADIOSTRONTIUM
MOVEMENT OF ALGAL- AND FUNGAL-BOUND RADIOSTRONTUM AS CHELATE COMPLEXES IN A CALCAREOUS SOIL,
W71-04067 05B

FUNGI
MOVEMENT OF ALGAL- AND FUNGAL-BOUND RADIOSTRONTUM AS CHELATE COMPLEXES IN A CALCAREOUS SOIL,
W71-04067 05B

MICROBIAL POPULATIONS IN STUBBLE-MULCHED SOIL,
W71-04068 02G

PREDATOR-PREY RELATIONSHIPS IN A MODEL FOR THE ACTIVATED PROCESS,
W71-04070 05D

FUNGICIDES
GAS CHROMATOGRAPHIC SEPARATIONS OF MIXED CHLORINATED FUNGICIDES,
W71-04213 05A

FWQA METHODS
USE OF A FLOATING PERIPHYTON SAMPLER FOR WATER POLLUTION SURVEILLANCE,
W71-04194 05B

METHODS OF COLLECTION AND ANALYSIS OF PLANKTON AND PERIPHYTON SAMPLES IN THE WATER POLLUTION SURVEILLANCE SYSTEM,
W71-04195 05A

LABORATORY GUIDE FOR THE IDENTIFICATION ON PETROLEUM PRODUCTS,
W71-04199 05A

FWPCA METHOD STUDY 1 MINERAL AND PHYSICAL ANALYSES - AN EVALUATION OF FWPCA ANALYTICAL METHODS FOR SURFACE WATERS,
W71-04200 05A

FWPCA METHODS FOR CHEMICAL ANALSIS OF WATER AND WASTES.
W71-04202 05A

METHOD SELECTION STUDY 1 A COMPARISON OF THREE MODIFICATIONS OF THE SINGLE REAGENT METHOD FOR SOLUBLE ORTHOPHOSPHATE,
W71-04204 05A

GAGES
REMOTE GROUNDWATER LEVEL METER FOR BOG STATIONS,
W71-03966 07B

GAGING STATIONS
CATALOG OF INFORMATION ON WATER DATA, EDITION 1970-INDEX TO SURFACE WATER SECTION.
W71-04151 07C

METHODS OF SNOWMELT MAXIMUM DISCHARGE COMPUTATION IN CASES OF ABSENCE OR INSUFFICIENCY OF HYDROMETRIC DATA,
W71-04177 02C

GAMMA RAYS
FLORIDA FIRM USES GAMMA RAYS TO POLISH SEWAGE PLANT EFFLUENT.
W71-03890 05D

GANGES RIVER VALLEY
DRY LANDS AND A HUNGRY WORLD,
W71-04291 06B

GAS CHROMATOGRAPHY
A CASE STUDY OF MICROORGANIC CONTAMINANTS IN RIVER WATER,
W71-04119 05A

ELIMINATION OF 'MEMORY' PEAKS ENCOUNTERED IN AQUEOUS-INJECTION GAS CHROMATOGRAPHY,
W71-04196 07B

LABORATORY GUIDE FOR THE IDENTIFICATION ON PETROLEUM PRODUCTS,
W71-04199 05A

MICRODETERMINATION OF DERIVATIVES OF PHENOLS AND MERCAPTANS BY MEANS OF ELECTRON CAPTURE GAS CHROMATOGRAPHY,
W71-04218 05A

GAS TRANSFER
ENGINEERING ASPECTS OF SURFACE AERATION DESIGN,
W71-04073 05D

GEOCHEMISTRY
SUBMARINE VOLCANISM AS A SOURCE FOR IRON,
W71-03955 02K

GEOGRAPHICAL REGIONS
WATER SUPPLY OUTLOOK FOR THE WESTERN UNITED STATES, 1970-71 WATER YEAR.
W71-03927 02B

SPATIAL PATTERNS OF SOCIO-ECONOMIC STRUCTURE IN INDIA,
W71-04234 06B

GEOLOGY
GEOLOGY AND GROUNDWATER RESOURCES OF ALLEN COUNTY, KANSAS,
W71-03937 02F

GEOMORPHOLOGY
SOME ASPECTS OF THE GEOMORPHOLOGY OF THE AIR MOUNTAINS, SOUTHERN SAHARA,
W71-04050 02G

SOME PROBLEMS OF A KARST AREA IN THE EASTERN TRANSVAAL, SOUTH AFRICA,
W71-04053 02G

CHAIN MODEL OF RIVER MEANDERS,
W71-04124 02E

GLACIAL RUNOFF
COMPUTATION OF FLOW IN GLACIER-FED RIVERS,
W71-03975 02E

GLACIER ALBEDO
PROBLEM OF THE CLASSIFICATION AND SPATIAL VARIABILITY OF THE ALBEDO OF A HOMOGENEOUS GLACIER SURFACE DURING THE ABLATION PERIOD,
W71-03971 02C

GLACIER MOVEMENT
SOME FEATURES OF THE MECHANICS OF GLACIER MOVEMENT,
W71-03972 02C

GLACIERS
PROBLEM OF THE CLASSIFICATION AND SPATIAL VARIABILITY OF THE ALBEDO OF A HOMOGENEOUS GLACIER SURFACE DURING THE ABLATION PERIOD,
W71-03971 02C

SOME FEATURES OF THE MECHANICS OF GLACIER MOVEMENT,
W71-03972 02C

COMPUTATION OF FLOW IN GLACIER-FED RIVERS,
W71-03975 02E

RECONSTRUCTION OF SUBGLACIAL RELIEF FROM RADIO ECHO SOUNDING RECORDS,
W71-04112 02C

EXCHANGE OF DEUTERIUM BETWEEN ICE AND WATER IN GLACIOLOGICAL STUDIES IN ICELAND,
W71-04137 02A

GLOBAL HYPOTHESES
NATURAL HAZARD IN HUMAN ECOLOGICAL PERSPECTIVE HYPOTHESES AND MODELS,
W71-04032 06G

GLOBAL STUDIES
SECULAR VARIATION OF ARIDITY IN THE WORLD,
W71-04288 02A

GOLDFISH
ACTION OF IRON SALTS IN SOLUTION ON GOLDFISH,
W71-03851 05C

GOVERNMENT FINANCES
A GUIDE TO USING INTEREST FACTORS IN ECONOMIC ANALYSIS OF WATER PROJECTS,
W71-04283 06B

GRADIENT PROJECTION METHOD
OPTIMIZATION OF WATER RESOURCES SYSTEMS BY THE GRADIENT PROJECTION METHOD,
W71-04047 06A

GRASSED WATERWAYS
THE EFFECT OF VEGETATION CONVERSION AND FLOOD DISCHARGE ON STREAM CHANNEL GEOMETRY THE CASE OF SOUTHERN CALIFORNIA WATERSHEDS,
W71-04230 04D

GRASSLANDS
FARMING, FOREST AND SAVANNA IN WESTERN NIGERIA,
W71-04054 03F

ECOLOGICAL SIGNIFICANCE OF ALIEN PLANTS IN CALIFORNIA GRASSLANDS,
W71-04233 04A

GRAZING
CLIMATE AND OVERGRAZING ON THE SHONTO PLATEAU, ARIZONA,
W71-04064 03F

GREAT BRITAIN
VARIATION IN THE LEVEL OF THE CLIFF/SHORE PLATFORM JUNCTION ALONG THE SOUTH COAST OF GREAT BRITAIN,
W71-03952 02J

GREAT LAKES
GREAT LAKES SHORELAND MANAGEMENT AND EROSION DAMAGE CONTROL FOR MICHIGAN.
W71-03908 02H

GREAT PLAINS CONSERVATION PROGRAM
THE IMPACT OF AGRICULTURAL CHANGE ON A LOCAL ECONOMY IN THE GREAT PLAINS,
W71-04289 03F

GROUNDWATER
UTILIZATION OF THE STORAGE POTENTIAL OF RIVER VALLEY AQUIFERS,
W71-03924 02F

AVAILABILITY OF GROUNDWATER IN WESTERN COWLITZ COUNTY, WASHINGTON,
W71-03934 02F

GROUNDWATER RESOURCES OF COLLINGSWORTH COUNTY, TEXAS,
W71-03935 02F

GEOLOGY AND GROUNDWATER RESOURCES OF ALLEN COUNTY, KANSAS,
W71-03937 02F

GROUNDWATER STORAGE CONTROL UNDER INSTITUTIONAL RESTRICTIONS,
W71-04024 04B

COMPUTER AIDS GROUNDWATER RESOURCES RESEARCH PROJECT,
W71-04057 02F

MOVEMENT OF AGRICULTURAL POLLUTANTS WITH GROUNDWATER,
W71-04121 05B

THE PUMPED WELL,
W71-04292 04B

GROUNDWATER ACT(ARIZONA)
WATER TABLE DECLINE AND RESULTANT AGRICULTURAL PATTERNS IN THE SALT RIVER VALLEY OF ARIZONA,
W71-04065 03F

GROUNDWATER BASINS
ARSENIC IN POTABLE DESERT GROUNDWATER AN ANALYSIS PROBLEM,
W71-04109 02K

GROUNDWATER HYDROLOGY
GEOLOGY AND GROUNDWATER RESOURCES OF ALLEN COUNTY, KANSAS,
W71-03937 02F

GROUNDWATER MOVEMENT
WASTE PROBLEMS RELATIVE TO MINING AND MILLING OF MOLYBDENUM,
W71-03888 05D

GEOHYDROLOGIC BOUNDARY ENVELOPES,
W71-04125 02F

FINITE AQUIFERS CHARACTERISTIC RESPONSES AND APPLICATIONS,
W71-04126 02F

ANALYTICAL SOLUTION OF THE LAPLACE EQUATION IN REGIONAL GROUNDWATER FLOW FIELD,
W71-04130 02F

WATER MOVEMENT IN THE UNSATURATED ZONE OF HIGH AND LOW PERMEABILITY STRATA BY MEASURING NATURAL TRITIUM,
W71-04138 02A

GROUNDWATER RECHARGE
OPTIMUM UTILIZATION AND MANAGEMENT OF WATER BEARING FORMATIONS HYDRAULICALLY CONNECTED TO A STRETCH OF THE CONNECTICUT RIVER,
W71-03919 04B

GROUNDWATER RESOURCES
AVAILABILITY OF GROUNDWATER IN WESTERN COWLITZ COUNTY, WASHINGTON,
W71-03934 02F

GROWTH RATES
THE EVALUATION OF ENVIRONMENTAL ALTERATION BY THERMAL LOADING AND ACID POLLUTION IN THE COOLING RESERVOIR OF A STEAM-ELECTRIC STATION,
W71-04019 05C

GUIDE TO BENEFIT-COST ANALYSIS
EVALUATION OF INTANGIBLES,
W71-04273 06B

HALOPHYTES
FORMATION OF PHYTOGENIC HILLOCKS II. ROOTING HABIT OF PLANTS FORMING PHYTOGENIC HILLOCKS,
W71-04295 02I

HATCHING
THE DEVELOPMENT OF EGGS OF THE RED LOCUST NOMADACRIS SEPTEMFASCIATA (SERV.), AND THE AFRICAN MIGRATORY LOCUST, LOCUSTA MIGRATORIA MIGRATORIODES (R. AND F.), AND ITS INTERRUPTION UNDER PARTICULAR CONDITIONS OF HUMIDITY,
W71-04297 03F

HAWAII
SOLUBILITY AND AVAILABILITY OF SORBED SULFATE IN HAWAIIAN SOILS,
W71-03941 02G

HAZARDS
NATURAL HAZARD IN HUMAN ECOLOGICAL PERSPECTIVE HYPOTHESES AND MODELS,
W71-04032 06G

HEAT BUDGET
PREDICTION OF SOLAR AND ATMOSPHERIC RADIATION FOR ENERGY BUDGET STUDIES OF LAKES AND STREAMS,
W71-04020 02B

HEAT TRANSFER
SECOND REPORT ON HORIZONTAL-TUBE MULTIPLE-EFFECT PROCESS PILOT PLANT TESTS AND DESIGN,
W71-04220 03A

HEATED WATER
THE EVALUATION OF ENVIRONMENTAL ALTERATION BY THERMAL LOADING AND ACID POLLUTION IN THE COOLING RESERVOIR OF A STEAM-ELECTRIC STATION,
W71-04019 05C

HIGH WATER MARK
COMPUTATION OF MAXIMUM STORM DISCHARGE OF MOUNTAIN RIVERS,
W71-03982 02A

HIGHWAYS
THE CONTROL OF EROSION AND SEDIMENT IN HIGHWAY CONSTRUCTION,
W71-04149 04D

HOOSIER CREEK(IOWA)
FLOOD PROFILE STUDY, HOOSIER CREEK, LINN COUNTY, IOWA,
W71-03932 02E

HORIZONTAL TUBE EVAPORATORS
SECOND REPORT ON HORIZONTAL-TUBE MULTIPLE-EFFECT PROCESS PILOT PLANT TESTS AND DESIGN,
W71-04220 03A

HUMAN POPULATION
RESPONSES OF NATIVE AND MIGRANT DESERT RESIDENTS TO ARID HEAT,
W71-04301 02I

HUMIC ACIDS
LIMNOLOGICAL FEATURES OF A NORTHERN BROWN-WATER STREAM, WITH SPECIAL REFERENCES TO THE LIFE HISTORIES OF THE AQUATIC INSECTS,
W71-04215 05C

HUMIDITY
THE DEVELOPMENT OF EGGS OF THE RED LOCUST NOMADACRIS SEPTEMFASCIATA (SERV.), AND THE AFRICAN MIGRATORY LOCUST, LOCUSTA MIGRATORIA MIGRATORIODES (R. AND F.), AND ITS INTERRUPTION UNDER PARTICULAR CONDITIONS OF HUMIDITY,
W71-04297 03F

ENVIRONMENTAL CONTROL OF COLORATION IN AN ACRIDID, GASTRIMARGUS AFRICANUS (SAUSSURE),
W71-04302 03F

HUNGARY
SOME PROBLEMS OF DETERMINING THE WATER EQUIVALENT OF THE SNOW COVER,
W71-04173 02C

HUNTING
STATE V PLANT (VIOLATION OF STATUTE PROHIBITING OPERATION OF BOAT FOR HUNTING DURING CERTAIN HOURS).
W71-04320 06E

HURRICANES
THE CALCULATION OF RAINFALL FROM A HURRICANE,
W71-03993 02B

HYBRIDS
ELEVATION AND TEMPERATURE EFFECTS ON SEVERITY OF MAIZE DWARF MOSAIC VIRUS IN SORGHUM,
W71-04060 03F

HYDRATION
CHEMICAL EXCHANGE BETWEEN SEA WATER AND DEEP OCEAN BASALTS,
W71-03956 02K

HYDRAULIC FILLS
SARATOV HYDROELECTRIC POWERPLANT CONSTRUCTION DATA,
W71-04017 08C

HYDRAULIC MACHINERY
EXPERIMENTAL INVESTIGATIONS OF HYDRAULIC TURBINES WITH COMBINED RUNNERS,
W71-03998 08C

HYDRAULIC MINING WATER
LEHIGH AND WILKES-BARRE COAL MINING CO V PITTSTON COAL MINING CO (DISCHARGE OF HYDRAULIC MINING WATER INTO CONTIGUOUS MINE).
W71-04332 06E

HYDRAULIC MODELS
THE INFLUENCE OF LANDFORM AND PRECIPITATION PARAMETERS ON FLOOD HYDROGRAPHS,
W71-03871 02E

SIMILITUDE CONCEPT IN PARTIALLY SATURATED SOILS,
W71-04131 02G

HYDRAULIC SIMILITUDE
SIMILITUDE CONCEPT IN PARTIALLY SATURATED SOILS,
W71-04131 02G

HYDRAULIC STRUCTURES
WATER MEASUREMENT PROCEDURES - IRRIGATION OPERATORS' WORKSHOP.
W71-04007 08B

HYDRAULIC TURBINES
EXPERIMENTAL INVESTIGATIONS OF HYDRAULIC TURBINES WITH COMBINED RUNNERS,
W71-03998 08C

HYDRAULICS
HYDRAULIC RESISTANCE AND FORMULA FOR COMPUTING THE AVERAGE FLOW VELOCITY OF MOUNTAIN RIVERS,
W71-03961 02E

WATER MEASUREMENT PROCEDURES - IRRIGATION OPERATORS' WORKSHOP.
W71-04007 08B

HYDROELECTRIC PLANTS
LOWE V INDIANA HYDROELECTRIC POWER CO (AUTHORITY OF HYDROELECTRIC COMPANY TO CONDEMN LAND FOR FLOWAGE).
W71-04217 06E

APPEAL OF PHILADELPHIA FELT CO (CONDEMNATION VALUE OF RIPARIAN LAND).
W71-04334 06E

HYDROGEN ION CONCENTRATION
SPRAY IRRIGATION OF WASTES FROM THE MANUFACTURE OF HARDBOARD,
W71-03886 05D

MULTI-STAGE BIOLOGICAL PROCESSES FOR WASTE TREATMENT,
W71-03894 05D

MINE WASTE WATER PROBLEMS IN EUROPE,
W71-03898 05D

HYDROGEN ISOTOPE DISTRIBUTION(CANADA)
DISTRIBUTION OF HYDROGEN ISOTOPES IN CANADIAN WATERS,
W71-04134 02A

HYDROGEOLOGY
THE RELATIONSHIP BETWEEN SUMMER LOW FLOWS AND GEOLOGY IN NORTHLAND, NEW ZEALAND,
W71-03931 02A

ISOTOPE HYDROLOGY, 1970.
W71-04133 02A

HYDROGRAPH ANALYSIS
THE INFLUENCE OF LANDFORM AND PRECIPITATION PARAMETERS ON FLOOD HYDROGRAPHS,
W71-03871 02E

CONSTRUCTION OF THE UNIT HYDROGRAPH BY THE METHOD OF HYDROLOGIC ANALOGY (FRENCH),
W71-03981 02E

HYDROGRAPH SYNTHESIS FOR WATERSHED SUBZONES FROM MEASURED URBAN PARAMETERS,
W71-04184 04C

HYDROGRAPHS
CHARACTERISTICS OF THE CONSTRUCTION OF EQUALLY PROBABLE FLASH FLOOD HYDROGRAPHS,
W71-03976 02E

HYDROLOGIC BUDGET
PROGRESS IN WATER DESALINATION TECHNOLOGY,
W71-04229 03A

HYDROLOGIC CYCLE
THE WORLD OF WATER,
W71-04118 02A

HYDROLOGIC DATA
WATER SUPPLY OUTLOOK FOR THE WESTERN UNITED STATES, 1970-71 WATER YEAR.
W71-03927 02B

QUALITY OF RUNOFF FROM DIVERSIFIED URBAN WATERSHEDS,
W71-03929 05A

A PROPOSED STREAMFLOW DATA PROGRAM FOR NEW YORK,
W71-03933 07A

AVAILABILITY OF GROUNDWATER IN WESTERN COWLITZ COUNTY, WASHINGTON,
W71-03934 02F

GROUNDWATER RESOURCES OF COLLINGSWORTH COUNTY, TEXAS,
W71-03935 02F

QUALITY OF SURFACE WATERS OF THE UNITED STATES, 1965 PARTS 7 AND 8. LOWER MISSISSIPPI RIVER BASIN AND WESTERN GULF OF MEXICO BASINS.
W71-04048 02K

CATALOG OF INFORMATION ON WATER DATA, EDITION 1970 - INDEX TO WATER QUALITY SECTION.
W71-04150 07C

CATALOG OF INFORMATION ON WATER DATA, EDITION 1970-INDEX TO SURFACE WATER SECTION.
W71-04151 07C

HYDROLOGY
SUPERPOSITION OF SUBMONTHLY FLOWS IN STOCHASTIC HYDROLOGY,
W71-04040 02E

THE WORLD OF WATER,
W71-04118 02A

ICELAND
EXCHANGE OF DEUTERIUM BETWEEN ICE AND WATER IN GLACIOLOGICAL STUDIES IN ICELAND,
W71-04137 02A

ICELAND ICE CAP
EXCHANGE OF DEUTERIUM BETWEEN ICE AND WATER IN GLACIOLOGICAL STUDIES IN ICELAND,
W71-04137 02A

ILLINOIS
COAL CREEK DRAINAGE AND LEVEE DIST V SANITARY DIST OF CHICAGO (DRAINAGE DISTRICT'S LIABILITY FOR DISCHARGE OF EXCESSIVE WATER INTO RIVER).
W71-04198 06E

HANOVER DRAINAGE AND LEVEE DIST V SANTA FE DRAINAGE AND LEVEE DIST (DRAINAGE DISTRICT'S AUTHORITY TO REMOVE NATURAL BARRIER AND CHANGE DIRECTION OF DRAINAGE FLOW).
W71-04246 06E

DUCK ISLAND HUNTING AND FISHING CLUB V EDWARD GILLEN DOCK, DREDGE AND CONSTRUCTION CO (DISSOLUTION OF DRAINAGE DISTRICT).
W71-04277 06E

IMPAIRED WATER QUALITY
ECORSE RIVER WATER QUALITY STUDY, MAY-JULY, 1969.
W71-03907 05B

INCOME STABILITY
IRRIGATION AS A FARM GROWTH STRATEGY,
W71-04290 03F

INCUBATION
THE DEVELOPMENT OF EGGS OF THE RED LOCUST NOMADACRIS SEPTEMFASCIATA (SERV.), AND THE AFRICAN MIGRATORY LOCUST, LOCUSTA MIGRATORIA MIGRATORIOIDES (R. AND F.), AND ITS INTERRUPTION UNDER PARTICULAR CONDITIONS OF HUMIDITY,
W71-04297 03F

INDIA
SPATIAL PATTERNS OF SOCIO-ECONOMIC STRUCTURE IN INDIA,
W71-04234 06B

DRY LANDS AND A HUNGRY WORLD,
W71-04291 06B

SOME ASPECTS OF DROUGHT CLIMATOLOGY OF THE DRY SUBHUMID ZONES OF SOUTH INDIA,
W71-04298 02B

INDIANA
LOWE V INDIANA HYDROELECTRIC POWER CO (AUTHORITY OF HYDROELECTRIC COMPANY TO CONDEMN LAND FOR FLOWAGE).
W71-04217 06E

PENNSYLVANIA RR V LINCOLN TRUST CO (RAILROAD AND MUNICIPAL NEGLIGENCE IN MAINTAINING WATER PURITY).
W71-04252 06E

INDUCED COSTS
CAN COSTS BE CUT,
W71-04284 06C

INDUCED INFILTRATION
OPTIMUM UTILIZATION AND MANAGEMENT OF WATER BEARING FORMATIONS HYDRAULICALLY CONNECTED TO A STRETCH OF THE CONNECTICUT RIVER,
W71-03919 04B

INDUSTRIAL WASTES
WASTE WATER TREATMENT FACILITIES AT BURNS HARBOR,
W71-04080 05D

INDUSTRIAL WATER
GEOGRAPHICAL ASPECTS OF THE USE OF WATER RESOURCES IN THE SOVIET ECONOMY,
W71-04052 03F

INFILTRATION
UTILIZATION OF THE STORAGE POTENTIAL OF RIVER VALLEY AQUIFERS,

W71-03924 02F

SATURATION-UNSATURATION TRANSITION IN INFILTRATION TO A NON-UNIFORM SOIL PROFILE,
W71-04066 02G

INFILTRATION AND SOIL EROSION AS INFLUENCED BY VEGETATION AND SOIL IN NORTHERN UTAH,
W71-04260 02J

INFILTRATION AND SOIL EROSION ON COOLWATER RIDGE, IDAHO,
W71-04261 02J

INFILTRATION IN CONTOUR TRENCHES IN THE SIERRA NEVADA,
W71-04263 04A

INFILTROMETERS
INFILTRATION IN CONTOUR TRENCHES IN THE SIERRA NEVADA,
W71-04263 04A

INFRARED RADIATION
ESTIMATION OF SEA SURFACE TEMPERATURE FROM SPACE,
W71-03959 07B

INFRARED RADIOMETRY
ESTIMATION OF SEA SURFACE TEMPERATURE FROM SPACE,
W71-03959 07B

INJUNCTION(PROHIBITORY)
LAND DEVELOPMENT, INC V LOUISVILLE GAS AND ELECTRIC CO (LIABILITY FOR FAULTY CONSTRUCTION OF CULVERT DIVERTING STREAM).
W71-04312 06E

INORGANIC MEMBRANES
THE STRUCTURE AND MORPHOLOGY OF INORGANIC MEMBRANES,
W71-04224 03A

INPUT-OUTPUT ANALYSIS
FINITE AQUIFERS CHARACTERISTIC RESPONSES AND APPLICATIONS,
W71-04126 02F

THE IMPACT OF AGRICULTURAL CHANGE ON A LOCAL ECONOMY IN THE GREAT PLAINS,
W71-04289 03F

INSECT EGGS
THE DEVELOPMENT OF EGGS OF THE RED LOCUST NOMADACRIS SEPTEMFASCIATA (SERV.), AND THE AFRICAN MIGRATORY LOCUST, LOCUSTA MIGRATORIA MIGRATORIOIDES (R. AND F.), AND ITS INTERRUPTION UNDER PARTICULAR CONDITIONS OF HUMIDITY,
W71-04297 03F

INSECTS
ENVIRONMENTAL CONTROL OF COLORATION IN AN ACRIDID, GASTRIMARGUS AFRICANUS (SAUSSURE),
W71-04302 03F

INSTITUTIONAL CONSTRAINTS
THE LEGAL SYSTEM STRUCTURE OR CONSTRAINT FOR SYSTEMS ANALYSIS DECISION-MAKING,
W71-03865 06E

INTERACTION AMONG NATURAL RESOURCE SYSTEMS, THE DECISION MAKERS AND THE PUBLIC IN THE 2000'S,
W71-03868 06B

ENVIRONMENTAL JURISDICTION IN THE CONGRESS AND THE EXECUTIVE,
W71-04106 06E

INSTITUTIONS
INSTITUTIONAL DESIGN FOR WATER QUALITY MANAGEMENT THE IMPLICATIONS OF A SYSTEMS APPROACH FOR LEGAL AND ADMINISTRATIVE ARRANGEMENTS,
W71-03867 06E

THE INSTITUTIONAL FRAMEWORK FOR WATER MANAGEMENT IN ENGLAND AND WALES,
W71-04282 06E

WATER AND CULTURE NEW DECISION RULES FOR OLD INSTITUTIONS,
W71-04296 06E

INSTRUMENTATION
ANALYTICAL INSTRUMENTS IN WATER POLLUTION CONTROL,
W71-04205 05A

INTANGIBLE BENEFITS
EVALUATION OF INTANGIBLES,
W71-04273 06B

INTEREST
PRIVATE AND SOCIAL COSTING AS DECISION DETERMINANTS IN WATER RESOURCES,
W71-03864 06B

A GUIDE TO USING INTEREST FACTORS IN ECONOMIC ANALYSIS OF WATER PROJECTS,
W71-04283 06B

INTERMITTENT PUMPING
THE PUMPED WELL,
W71-04292 04B

INTERNATIONAL ATOMIC ENERGY AGENCY
ISOTOPE HYDROLOGY, 1970.
W71-04133 02A

INTERNATIONAL LAW
DEVELOPMENT OF OCEAN SPACE--AN INTERNATIONAL DILEMMA,
W71-04098 06E

CONTINENTAL SHELF LAW OUTDISTANCED BY SCIENCE AND TECHNOLOGY,
W71-04100 06E

INTERNATIONAL WATERS
TOWARDS A BETTER USE OF THE OCEAN CONTEMPORARY LEGAL PROBLEMS IN OCEAN DEVELOPMENT,
W71-04338 06E

INTERSTATE COMMERCE
GARDEN CLUB OF VIRGINIA V VIRGINIA PUBLIC SERVICE CO (JURISDICTION OF CORPORATION COMMISSION TO GRANT PERMIT FOR DAM ON NON-NAVIGABLE RIVER).
W71-04343 06E

INTERSTATE COMMISSIONS
THE PROPOSED POTOMAC RIVER BASIN COMPACT,
W71-04090 06E

INTERSTATE COMPACTS
THE DELAWARE RIVER BASIN COMPACT--AN ALTERNATIVE FOR IMPLEMENTING WATER RESOURCES MANAGEMENT (ORGANIZATION, OPERATION, AND RESULTS OF THE BASIN COMPACT),
W71-04089 06E

DELAWARE RIVER BASIN COMPACT.
W71-04093 06E

INTERTIDAL AREAS
DEPOSITIONAL AND DISPERSAL DYNAMICS OF INTERTIDAL SAND BARS,
W71-03948 02J

INTERTROPICAL CONVERGENCE ZONE
THE CLIMATE OF INTERIOR OMAN,
W71-04227 02B

INVERTEBRATES
STUDY OF WATER POLLUTION PROBLEMS WHICH AFFECT FISH AND OTHER AQUATIC FORMS,
W71-03852 05C

INVESTIGATIONS
ANALYSIS OF SNOW MELT FLOODS,
W71-04179 02E

INVESTMENT
NEW HORIZONS IN WATER RESOURCES ADMINISTRATION,
W71-03887 06E

ION DIFFUSION
THE DIFFUSION OF IONS IN UNCONSOLIDATED SEDIMENTS,
W71-03954 02K

ION EXCHANGE
CHEMICAL EXCHANGE BETWEEN SEA WATER AND DEEP OCEAN BASALTS,
W71-03956 02K

ION TRANSPORT
DENTISTRY PROFESSOR EXPLAINS POLYWATER.
W71-03926 01B

THE DIFFUSION OF IONS IN UNCONSOLIDATED SEDIMENTS,
W71-03954 02K

IOWA
FLOOD PROFILE STUDY, HOOSIER CREEK, LINN COUNTY, IOWA,
W71-03932 02E

POWER OF CITIES AND TOWNS TO PROVIDE DRAINAGE AND SEWAGE FACILITIES.
W71-04081 06E

MEEKER V KAUTZ (TITLE TO ISLANDS IN NAVIGABLE RIVER).
W71-04331 06E

IRAQ
MINERALOGY OF SOME ARID AND SEMIARID LAND SOILS OF IRAQ,
W71-04061 02G

IRON
SUBMARINE VOLCANISM AS A SOURCE FOR IRON,
W71-03955 02K

WASTE WATER RESULTING FROM THE CONCENTRATION OF LOW GRADE IRON ORE,
W71-04083 05D

IRON COMPOUNDS
ACTION OF IRON SALTS IN SOLUTION ON GOLDFISH,
W71-03851 05C

IRON EXCHANGE
CHEMICAL EXFOLIATED VERMICULITE FOR REMOVAL OF PHOSPHATE FROM WASTE WATERS,
W71-04107 05D

IRRIGATED CROPS
ELEVATION AND TEMPERATURE EFFECTS ON SEVERITY OF MAIZE DWARF MOSAIC VIRUS IN SORGHUM,
W71-04060 03F

IRRIGATION
WATER MEASUREMENT PROCEDURES - IRRIGATION OPERATORS' WORKSHOP.
W71-04007 08B

RECLAMATION IN THE UNITED STATES,
W71-04306 06C

IRRIGATION EFFICIENCY
INFLUENCE OF LOW RATES OF WATER APPLICATION BY SPRINKLERS ON THE MICROCLIMATE,
W71-03925 02D

IRRIGATION AS A FARM GROWTH STRATEGY,
W71-04290 03F

ALTERNATIVE CROP ENTERPRISE BUDGETS FOR IRRIGATED PRODUCTION, SOUTHWESTERN OKLAHOMA,
W71-04294 03F

IRRIGATION PRACTICES
GEOGRAPHICAL ASPECTS OF THE USE OF WATER RESOURCES IN THE SOVIET ECONOMY,
W71-04052 03F

SUPERFARMS VS. SAGEBRUSH NEW IRRIGATION DEVELOPMENTS ON THE SNAKE RIVER PLAIN,
W71-04056 03F

WATER TABLE DECLINE AND RESULTANT AGRICULTURAL PATTERNS IN THE SALT RIVER VALLEY OF ARIZONA,
W71-04065 03F

IRRIGATION DEVELOPMENT IN TUNISIA,
W71-04232 03F

AN ECONOMIC ANALYSIS OF LEVEL BENCH SYSTEMS FOR FORAGE PRODUCTION IN NORTH DAKOTA,
W71-04265 03F

IRRIGATION SYSTEMS
ASPECTS OF THE SOUTH AUSTRALIAN CITRUS INDUSTRY,
W71-04051 03F

THE LOCATION OF LAND USE TYPES THE NILE VALLEY IN NORTHERN SUDAN,
W71-04228 04A

NEW APPROACHES TO IRRIGATED FARMING IN THE SUDAN ORGANIZATION AND MANAGEMENT,
W71-04231 03F

IRRIGATION DEVELOPMENT IN TUNISIA,
W71-04232 03F

IRRIGATION WATER
DEVELOPMENT OF ECONOMICAL METHODS OF BORON REMOVAL FROM IRRIGATION RETURN WATERS,
W71-03914 05D

ENGINEERING FEASIBILITY DEMONSTRATION STUDY FOR MUSKEGON COUNTY, MICHIGAN, WASTE WATER TREATMENT-IRRIGATION SYSTEM.
W71-04186 05D

EVALUATION OF IRRIGATION WATER AND NITROGEN FERTILIZER IN CORN PRODUCTION,
W71-04304 03F

IRTYSH RIVER
PATTERN OF VARIATION OF THE LENGTH OF FREELY MEANDERING RIVERS,
W71-03969 02J

ISLANDS
HANSON V BERT WAY ESTATE (RIPARIAN RIGHTS OF ADVERSE POSSESSOR).
W71-04315 06E

MEEKER V KAUTZ (TITLE TO ISLANDS IN NAVIGABLE RIVER).
W71-04331 06E

ISRAEL
ENVIRONMENTAL ISOTOPE BALANCE OF LAKE TIBERIAS,
W71-04140 02A

JAPAN
SOME EXAMPLES OF HEAVY RAINFALL IN JAPAN,
W71-04166 02B

JET STREAMS
SOME EXAMPLES OF HEAVY RAINFALL IN JAPAN,
W71-04166 02B

KANAWHA RIVER
USING MACROINVERTEBRATE COLLECTIONS FOR WATER QUALITY MONITORING IN THE OHIO RIVER BASIN 1963-1966,
W71-04208 05C

KANSAS
GEOLOGY AND GROUNDWATER RESOURCES OF ALLEN COUNTY, KANSAS,
W71-03937 02F

KARST
SOME PROBLEMS OF A KARST AREA IN THE EASTERN TRANSVAAL, SOUTH AFRICA,
W71-04053 02G

KENTUCKY
KENTUCKY WATER RESOURCES 1965 (SUMMARY OF INFORMATION INVOLVING KENTUCKY'S WATER RESOURCES).
W71-04021 06E

LAND DEVELOPMENT, INC V LOUISVILLE GAS AND ELECTRIC CO (LIABILITY FOR FAULTY CONSTRUCTION OF CULVERT DIVERTING STREAM).
W71-04312 06E

ELKHORN CITY LAND CO V ELKHORN CITY (ABANDONMENT OF WATER WORKS PROPERTY).
W71-04313 06E

CITY OF LEXINGTON V LEXINGTON WATER CO (WATER COMPANY'S PROFIT IN LAND SALE NOT RELEVANT IN FIXING RATES).
W71-04316 06E

KINETICS
KINETICS OF FIXED FILM BIOLOGICAL REACTORS,
W71-04085 05D

KLAMATH RIVER
ARTIFICIAL SUBSTRATE SAMPLING, MACROINVERTEBRATES IN A POLLUTED REACH OF THE KLAMATH RIVER, OREGON,
W71-04191 05A

KURA RIVER(USSR)
RADIOMETRIC INVESTIGATIONS ON THE BEACH AT THE MOUTH OF THE KURA RIVER,
W71-03962 02J

LABORATORY EQUIPMENT
A CHAMBER FOR OFFERING ALTERNATIVE CONDITIONS TO SMALL MOTILE AQUATIC ANIMALS,
W71-03853 05C

REARING DEVICES FOR STREAM INSECT LARVAE,
W71-04190 07B

EVALUATION REPORT 1 AUTOMATIC BEAKER SAMPLE CHANGER,
W71-04192 07B

ANALYTICAL INSTRUMENTS IN WATER POLLUTION CONTROL,
W71-04205 05A

LABORATORY TECHNIQUES
REARING DEVICES FOR STREAM INSECT LARVAE,
W71-04190 07B

FWPCA METHODS FOR CHEMICAL ANALSIS OF WATER AND WASTES.
W71-04202 05A

LAKE MEAD
A COMPREHENSIVE WATER QUALITY CONTROL PROGRAM FOR THE LAS VEGAS WASH DRAINAGE BASIN. PHASE I.
W71-03901 05D

A COMPREHENSIVE WATER QUALITY CONTROL PROGRAM FOR THE LAS VEGAS WASH DRAINAGE BASIN.
W71-03902 05D

LAKE MICHIGAN
PROCEEDINGS CONFERENCE ON POLLUTION OF LAKE MICHIGAN AND ITS TRIBUTARY BASIN, ILLINOIS, INDIANA, MICHIGAN, AND WISCONSIN.
W71-04256 05G

LAKE NEUSIEDL(AUSTRIA)
STABLE ISOTOPES IN STUDY OF WATER BALANCE OF LAKE NEUSIEDL, AUSTRIA INVESTIGATION OF THE RELIABILITY OF THE STABLE ISOTOPE METHOD,
W71-04141 02A

LAKE TIBERIAS(ISRAEL)
ENVIRONMENTAL ISOTOPE BALANCE OF LAKE TIBERIAS,
W71-04140 02A

LAKE WILCOX(VIRGINIA)
A WINTER LIMNOLOGICAL STUDY OF LAKE WILCOX A FRESHWATER IMPOUNDMENT,
W71-03957 02H

LAKES
A WINTER LIMNOLOGICAL STUDY OF LAKE WILCOX A FRESHWATER IMPOUNDMENT,
W71-03957 02H

QUANTITATIVE ASPECTS OF THE STUDY OF WATER BALANCES IN LAKES USING THE DEUTERIUM AND OXYGEN-18 CONCENTRATIONS IN THE WATER, (FRENCH),
W71-04139 02A

ENVIRONMENTAL ISOTOPE BALANCE OF LAKE TIBERIAS,
W71-04140 02A

STABLE ISOTOPES IN STUDY OF WATER BALANCE OF LAKE NEUSIEDL, AUSTRIA INVESTIGATION OF THE RELIABILITY OF THE STABLE ISOTOPE METHOD,
W71-04141 02A

PERCH LAKE EVAPORATION STUDY,
W71-04142 02A

LAND AND WATER CONSERVATION FUND ACT OF 1965
THE LAND AND WATER CONSERVATION FUND ACT DEVELOPMENT AND IMPACT,
W71-04097 06E

LAND FORMING
SOME ASPECTS OF THE GEOMORPHOLOGY OF THE AIR MOUNTAINS, SOUTHERN SAHARA,
W71-04050 02G

LAND RECLAMATION
SUPERFARMS VS. SAGEBRUSH NEW IRRIGATION DEVELOPMENTS ON THE SNAKE RIVER PLAIN,
W71-04056 03F

RECLAMATION IN THE UNITED STATES,
W71-04306 06C

BUREAU OF RECLAMATION APPROPRIATION ACTS AND ALLOTMENTS.

W71-04309 09D

LAND TENURE
NEW APPROACHES TO IRRIGATED FARMING IN THE SUDAN ORGANIZATION AND MANAGEMENT,
W71-04231 03F

PARKS V PENNSYLVANIA RR (TITLE TO LAND PREVIOUSLY FLOOD BY BACKWATER).
W71-04243 06E

HUNTER V VAN KEUREN (BOUNDARY DISPUTE AT LAKESHORE).
W71-04276 06E

ELKHORN CITY LAND CO V ELKHORN CITY (ABANDONMENT OF WATER WORKS PROPERTY).
W71-04313 06E

SCANLAN V HOPKINS (LEGAL CONSEQUENCES OF AGREEMENT BY GRANTOR TO CONSTRUCT CULVERT OVER NATURAL WATERCOURSE).
W71-04314 06E

WILSON V ST REGIS PULP AND PAPER CORP (BOUNDARY LINE BETWEEN PROPERTIES LOCATED ON OPPOSITE SIDES OF STREAM).
W71-04317 06E

PEOPLE V TRUSTEES OF FREEHOLDERS (VALIDITY OF PRE-STATEHOOD PATENTS TO BEDS UNDER NAVIGABLE WATERS).
W71-04328 06E

BAUMHART V MCCLURE (OWNERSHIP OF RIPARIAN LAND AFTER SUSTAINED SUBMERGENCE).
W71-04330 06E

MEEKER V KAUTZ (TITLE TO ISLANDS IN NAVIGABLE RIVER).
W71-04331 06E

PEOPLE V ZORA REALTY CO (ATTEMPT TO DECLARE PATENT IN SUBMERGED LANDS VOID FOR NONUSE).
W71-04348 06E

LAND USE
1969 RESERVOIR LAND USE SURVEYS FIELD REPORT AND PROCEDURAL MANUAL,
W71-04039 04A

RIPARIAN AND LITTORAL RIGHTS A SURVEY OF SOME OF THE LEGAL PROBLEMS INVOLVED IN RESIDENTIAL AND COMMERCIAL USES ALONG THE WATER'S EDGE IN RELATION TO THE SUBSTANTIVE ASPECTS OF PUBLIC POLICY,
W71-04095 06E

THE LOCATION OF LAND USE TYPES THE NILE VALLEY IN NORTHERN SUDAN,
W71-04228 04A

ELKHORN CITY LAND CO V ELKHORN CITY (ABANDONMENT OF WATER WORKS PROPERTY).
W71-04313 06E

LAND USE CAPABILITIES
MINERALOGY OF SOME ARID AND SEMIARID LAND SOILS OF IRAQ,
W71-04061 02G

LANDFILLS
EFFECT OF SOLID WASTE DISPOSAL ON GROUNDWATER QUALITY,
W71-04116 05C

BAY RIDGE DOCK CO V UNITED DRY DOCKS, INC (RIGHT TO FILL TO BULKHEAD LINE INCLUDES RIGHT TO MAINTAIN FLOATING DRY DOCK).
W71-04245 06E

LANDING FIELDS
INVESTIGATION OF AIRFIELD DRAINAGE ARCTIC AND SUBARCTIC REGIONS, SUPPLEMENT TO PART I, FIELD RECONNAISSANCE AND ANALYSIS,
W71-04002 04A

MOLE DRAINAGE,
W71-04008 08A

LAPLACES EQUATION
ANALYTICAL SOLUTION OF THE LAPLACE EQUATION IN REGIONAL GROUNDWATER FLOW FIELD,
W71-04130 02F

LARVAE
WATER QUALITY - BENTHIC INVERTEBRATE RELATIONSHIPS IN ESTUARIES,
W71-03922 05C

BEARING DEVICES FOR STREAM INSECT LARVAE,
W71-04190 07B

LAS VEGAS VALLEY
A COMPREHENSIVE WATER QUALITY CONTROL PROGRAM FOR THE LAS VEGAS WASH DRAINAGE BASIN. PHASE I.
W71-03901 05D

A COMPREHENSIVE WATER QUALITY CONTROL PROGRAM FOR THE LAS VEGAS WASH DRAINAGE BASIN.
W71-03902 05D

LAW OF THE SEA
DEVELOPMENT OF OCEAN SPACE--AN INTERNATIONAL DILEMMA,
W71-04098 06E

TOWARDS A BETTER USE OF THE OCEAN CONTEMPORARY LEGAL PROBLEMS IN OCEAN DEVELOPMENT,
W71-04338 06E

LEACHING NUTRIENTS
ACCUMULATION OF PHOSPHATES IN WATER,
W71-04216 05B

LEAD
A DIRECT-READING SPECTROCHEMICAL PROCEDURE FOR THE MEASUREMENT OF NINETEEN MINOR ELEMENTS IN NATURAL WATER,
W71-04211 05A

LEASES
HYDRAULIC RACE CO V GREENE (INTERPRETATION OF LEASE PROVIDING FOR USE OF ALL SURPLUS WATERS OF CANAL).
W71-04074 06E

LEBISTES RETICULATUS
THE EFFECT OF SOME SOLVENTS ON LOWER WATER ANIMALS AND ON FISHES,
W71-03854 05C

LEGAL ASPECTS
THE LEGAL SYSTEM STRUCTURE OR CONSTRAINT FOR SYSTEMS ANALYSIS DECISION-MAKING,
W71-03865 06E

CONDITIONS OF LEGAL AND POLITICAL FEASIBILITY,
W71-03866 06E

INSTITUTIONAL DESIGN FOR WATER QUALITY MANAGEMENT THE IMPLICATIONS OF A SYSTEMS APPROACH FOR LEGAL AND ADMINISTRATIVE ARRANGEMENTS,
W71-03867 06E

KENTUCKY WATER RESOURCES 1965 (SUMMARY OF INFORMATION INVOLVING KENTUCKY'S WATER RESOURCES).
W71-04021 06E

CHESAPEAKE BAY IN LEGAL PERSPECTIVE,
W71-04337 06E

LEGAL SYSTEM
THE LEGAL SYSTEM STRUCTURE OR CONSTRAINT FOR SYSTEMS ANALYSIS DECISION-MAKING,
W71-03865 06E

LEGAL-ADMINISTRATIVE REFORM
INSTITUTIONAL DESIGN FOR WATER QUALITY MANAGEMENT THE IMPLICATIONS OF A SYSTEMS APPROACH FOR LEGAL AND ADMINISTRATIVE ARRANGEMENTS,
W71-03867 06E

LEGISLATION
RECOMMENDATIONS CONCERNING PROPOSED LEGISLATION TO AUTHORIZE WATER MANAGEMENT DISTRICTS IN FLORIDA.
W71-03878 06E

A NATIONAL POLICY FOR THE ENVIRONMENT SELECTED EXCERPTS FROM THE CONGRESSIONAL RECORD AND CONGRESSIONAL DOCUMENTS, FALL, 1969, 91ST CONGRESS. 1ST SESSION.
W71-04092 06E

INFORMATION FOR APPLICANTS FOR CONSTRUCTION, ALTERATION, OR REPAIR OF DAMS.
W71-04094 06E

THE LAND AND WATER CONSERVATION FUND ACT DEVELOPMENT AND IMPACT,
W71-04097 06E

INSURING MAXIMUM BENEFICIAL USE OF WATER THROUGH LEGISLATION,
W71-04099 06E

WATER QUALITY CONTROL A MODERN APPROACH TO STATE REGULATION,
W71-04101 06E

WATERSHED PROJECTS.
W71-04104 06E

ENVIRONMENTAL JURISDICTION IN THE CONGRESS AND THE EXECUTIVE,
W71-04106 06E

PUBLIC WORKS AUTHORIZATIONS, 1968 - RIVERS AND HARBORS - FLOOD CONTROL AND MULTIPLE PURPOSE PROJECTS - PART I.
W71-04254 06E

HEARINGS BEFORE THE SUBCOMMITTEE ON FLOOD CONTROL - RIVERS AND HARBORS THE COMMITTEE ON PUBLIC WORKS, UNITED STATES SENATE, 90TH CONGRESS, 2ND SESSION.
W71-04255 06E

MANNING V METROPOLITAN DISTRICT COMM'N (CONSTITUTIONALITY OF ACT AUTHORIZING CONDEMNATION FOR DRAINAGE).
W71-04279 06E

OFFSHORE OIL SPILLS AN EVALUATION OF RECENT UNITED STATES RESPONSES,
W71-04305 06E

FEDERAL WATER-POWER LEGISLATION,
W71-04307 06E

BUREAU OF RECLAMATION APPROPRIATION ACTS AND ALLOTMENTS.
W71-04309 09D

REORGANIZATION PLAN NO. 3 OF 1970 (ENVIRONMENTAL PROTECTION AGENCY).
W71-04325 06E

HALEY V DAVENPORT (CONSTITUTIONALITY OF STATUTE AUTHORIZING

TRESPASS TO DRAIN SWAMPS AND PONDS).
W71-04341 06E

LEMONS
ROOTSTOCKS FOR VALENCIA ORANGES AND LIBSON LEMONS IN ARIZONA,
W71-04059 03F

LIMNOLOGY
A WINTER LIMNOLOGICAL STUDY OF LAKE WILCOX A FRESHWATER IMPOUNDMENT,
W71-03957 02H

LINEAR DECISION RULE(LDR)
REPLY,
W71-04035 06B

LINEAR PROGRAMMING
A QUANTITATIVE FRAMEWORK FOR RESIDUALS--ENVIRONMENTAL QUALITY MANAGEMENT,
W71-03858 05G

THE EVALUATION OF THE COST OF ALTERNATIVE STRATEGIES FOR AIR POLLUTION CONTROL,
W71-03859 06A

OPTIMAL ALLOCATION OF STOCHASTIC WATER SUPPLY,
W71-04028 03B

COMMENTS ON 'THE LINEAR DECISION RULE IN RESERVOIR MANAGEMENT AND DECISION RULE IN RESERVOIR MANAGEMENT AND DESIGN' BY CHARLES REVELLE, ERHARD JOERES AND WILLIAM KIRBY,
W71-04029 06B

MATHEMATICAL PROGRAMMING APPLICATIONS TO WATER QUALITY PLANNING FOR THE BOSTON HARBOR REGION,
W71-04036 05G

LINN COUNTY(IOWA)
FLOOD PROFILE STUDY, HOOSIER CREEK, LINN COUNTY, IOWA,
W71-03932 02E

LIPIDS
THE ELECTRON CAPTURE DETECTOR IN THE ANALYSIS OF CHLORINATED HYDROCARBON PESTICIDES IN TISSUES WITH AND WITHOUT CLEAN-UP,
W71-04214 05A

LIQUID WASTES
DESIGN OF ACTIVATED CARBON ADSORPTION BEDS,
W71-03897 05D

LITTLE MIAMI RIVER
A NEW FRESHWATER CENTRIC DIATOM MICROSIPHONA POTAMOS GEN. ET SP. NOV.,
W71-04193 05C

LITTORAL
RIPARIAN AND LITTORAL RIGHTS A SURVEY OF SOME OF THE LEGAL PROBLEMS INVOLVED IN RESIDENTIAL AND COMMERCIAL USES ALONG THE WATER'S EDGE IN RELATION TO THE SUBSTANTIVE ASPECTS OF PUBLIC POLICY,
W71-04095 06E

LITTORAL DRIFT
GREAT LAKES SHORELAND MANAGEMENT AND EROSION DAMAGE CONTROL FOR MICHIGAN.
W71-03908 02H

LOCUSTS
ENVIRONMENTAL CONTROL OF COLORATION IN AN ACRIDID, GASTRIMARGUS AFRICANUS (SAUSSURE),
W71-04302 03F

LOGGING(RECORDING)
GLOSSARY OF TERMS USED IN WELL LOGGING,
W71-04113 10

LONG-TERM PLANNING
ECONOMIC CONSIDERATIONS IN FACILITY PLANNING,
W71-04285 06B

LONG-TUBE VERTICAL DISTILLATION
EVALUATION OF THE VERTICAL TUBE EVAPORATOR AND THE MULTISTAGE FLASH DESALINATION PROCESSES.
W71-03913 03A

LOS ANGELES COUNTY
CLOUD SEEDING POTENTIALITIES IN LOS ANGELES COUNTY.
W71-03903 03B

LOUISIANA
WHITE V STATE (VALIDITY OF GRANT OF SUBMERGED STATE LANDS).
W71-04350 06E

LOW FLOW
THE RELATIONSHIP BETWEEN SUMMER LOW FLOWS AND GEOLOGY IN NORTHLAND, NEW ZEALAND,
W71-03931 02A

DETERMINATION OF THE DISTRIBUTION OF RAINFALL FLOODS IN LARGE CATCHMENTS USING HYDROMETEOROLOGICAL DATA,
W71-03977 02E

LOWER MISSISSIPPI RIVER BASIN
QUALITY OF SURFACE WATERS OF THE UNITED STATES, 1965 PARTS 7 AND 8. LOWER MISSISSIPPI RIVER BASIN AND WESTERN GULF OF MEXICO BASINS.
W71-04048 02K

LOW-RATE SPRINKLER IRRIGATION
INFLUENCE OF LOW RATES OF WATER APPLICATION BY SPRINKLERS ON THE MICROCLIMATE,
W71-03925 02D

MACHINE DESIGN
EXPERIMENTAL INVESTIGATIONS OF HYDRAULIC TURBINES WITH COMBINED RUNNERS,
W71-03998 08C

MACROINVERTEBRATES
A LIMESTONE-FILLED, ARTIFICIAL SUBSTRATE SAMPLER-FLOAT UNIT FOR COLLECTING MACROINVERTEBRATES IN LARGE STREAMS,
W71-04219 07B

MAINE
LAW OF SEASHORE, WATERS AND WATERCOURSES OF MAINE AND MASSACHUSETTS,
W71-04257 04A

STATE V PLANT (VIOLATION OF STATUTE PROHIBITING OPERATION OF BOAT FOR HUNTING DURING CERTAIN HOURS).
W71-04320 06E

BOOBER V TOWNE (ROAD DEPARTMENT'S LIABILITY FOR INCREASING THE FLOW OF WATER OVER CONTIGUOUS LAND).
W71-04333 06E

HALEY V DAVENPORT (CONSTITUTIONALITY OF STATUTE AUTHORIZING TRESPASS TO DRAIN SWAMPS AND PONDS).
W71-04341 06E

MAIZE DWARF MOSAIC VIRUS(MDM)
ELEVATION AND TEMPERATURE EFFECTS ON SEVERITY OF MAIZE DWARF MOSAIC VIRUS IN SORGHUM,
W71-04060 03F

MALAYSIA
THE PROBLEM OF FLOOD PREDICTION ON THE EAST COAST OF WEST MALAYSIA,
W71-04167 02B

THE CIRCULATION PATTERN OVER SINGAPORE AND THE EAST COAST OF WEST MALAYSIA DURING JANUARY AND FEBRUARY 1967 COMPARED WITH THAT OF JANUARY AND FEBRUARY 1968,
W71-04170 02B

MAPS
MAP OF TOTAL STREAMFLOW FROM THE TERRITORY OF THE SOVIET UNION,
W71-03960 02E

MARINAS
ECONOMIC ANALYSIS OF MARINAS IN MARYLAND,
W71-04267 06D

MARKETING
ASPECTS OF THE SOUTH AUSTRALIAN CITRUS INDUSTRY,
W71-04051 03F

MARYLAND
ECONOMIC ANALYSIS OF MARINAS IN MARYLAND,
W71-04267 06D

CITYCO REALTY CO V MAYOR, COUNSELOR, AND ALDERMAN OF ANNAPOLIS (RIGHT OF CITY TO DISCHARGE SEWAGE INTO STREAM).
W71-04319 06E

CHESAPEAKE BAY IN LEGAL PERSPECTIVE,
W71-04337 06E

RAGAN V SUSQUEHANNA POWER CO (DAMAGES FOR FAILURE TO RELOCATE ROAD FLOODED BY DAM BACKWATER).
W71-04340 06E

MASS CONCRETE
CONCRETE FOR KRASNOLARSK DAM,
W71-04004 08F

MASSACHUSETTS
RIGHTS TO SURFACE AND SUBSURFACE WATER IN MASSACHUSETTS.
W71-03882 06E

LAW OF SEASHORE, WATERS AND WATERCOURSES OF MAINE AND MASSACHUSETTS,
W71-04257 04A

MANNING V METROPOLITAN DISTRICT COMM'N (CONSTITUTIONALITY OF ACT AUTHORIZING CONDEMNATION FOR DRAINAGE).
W71-04279 06E

MASSIFS
SOME ASPECTS OF THE GEOMORPHOLOGY OF THE AIR MOUNTAINS, SOUTHERN SAHARA,
W71-04050 02G

MATHEMATICAL MODELING
STREAM QUALITY MODELING BY QUASILINEARIZATION,
W71-04045 05F

MATHEMATICAL MODELS
A QUANTITATIVE FRAMEWORK FOR RESIDUALS--ENVIRONMENTAL QUALITY MANAGEMENT,
W71-03858 05G

THE EVALUATION OF THE COST OF ALTERNATIVE STRATEGIES FOR AIR POLLUTION CONTROL,
W71-03859 06A

PLANNING FOR THE OSWEGO BASIN IN NEW YORK--A SYSTEMS APPROACH,
W71-03860 06A

ANALYSIS OF STOCHASTIC HYDROLOGIC SYSTEMS,
W71-03869 02A

MATHEMATICAL MODELS AS AN AID IN THE SOLUTION OF WATER POLLUTION CONTROL PROBLEMS,
W71-03884 05G

DESIGN OF PLUGFLOW POST AERATION BASIN,
W71-03889 05D

COMPUTER DESIGN OF SEWAGE TREATMENT PLANTS,
W71-03893 05D

A MULTI-PHASIC COMPONENT STUDY TO PREDICT STORM WATER POLLUTION FROM URBAN AREAS,
W71-03917 05C

DERIVATION OF A GENERAL FLOOD WAVE HYDROGRAPH FROM A CONTINUOUS WATERSHED WATER BALANCE,
W71-03989 02E

GROUNDWATER STORAGE CONTROL UNDER INSTITUTIONAL RESTRICTIONS,
W71-04024 04B

DESIGN CAPACITIES TO ACCOMMODATE FORECAST UNDERTAINTIES,
W71-04026 06A

MATHEMATICAL PROGRAMMING APPLICATIONS TO WATER QUALITY PLANNING FOR THE BOSTON HARBOR REGION,
W71-04036 05G

A WATER-QUALITY SIMULATION MODEL FOR WELL-MIXED ESTUARIES AND COASTAL SEAS VOLUME I, PRINCIPLES OF COMPUTATION,
W71-04038 06A

OPTIMAL OPERATION OF WATER SUPPLY SYSTEMS,
W71-04042 04B

A SIMPLE CASCADE WATERSHED MODEL,
W71-04181 02A

MATHEMATICAL STUDIES
ANALYSIS OF STOCHASTIC HYDROLOGIC SYSTEMS,
W71-03869 02A

MAXIMUM PROBABLE FLOOD
METHOD OF ESTIMATING STORM RUNOFF FROM SMALL DRAINAGE BASINS,
W71-03992 02E

MAYFLY
LIMNOLOGICAL FEATURES OF A NORTHERN BROWN-WATER STREAM, WITH SPECIAL REFERENCES TO THE LIFE HISTORIES OF THE AQUATIC INSECTS,
W71-04215 05C

MEANDERS
PATTERN OF VARIATION OF THE LENGTH OF FREELY MEANDERING RIVERS,
W71-03969 02J

CHAIN MODEL OF RIVER MEANDERS,
W71-04124 02E

MEJERDA RIVER
IRRIGATION DEVELOPMENT IN TUNISIA,
W71-04232 03F

MELT WATER
COMPUTATION OF FLOW IN GLACIER-FED RIVERS,
W71-03975 02E

EXCHANGE OF DEUTERIUM BETWEEN ICE AND WATER IN GLACIOLOGICAL STUDIES IN ICELAND,
W71-04137 02A

MELTING
COMPUTATION OF FLOW IN GLACIER-FED RIVERS,
W71-03975 02E

EXCHANGE OF DEUTERIUM BETWEEN ICE AND WATER IN GLACIOLOGICAL STUDIES IN ICELAND,
W71-04137 02A

MEMBRANE PROCESSES
WATER TRANSPORT THROUGH PLASTICIZED MEMBRANES,
W71-03912 03A

FABRICATION OF FELT-MEMBRANE COMPOSITES,
W71-04222 03A

MEMBRANES
MEMBRANE MATERIALS FOR WASTE WATER RECLAMATION BY REVERSE OSMOSIS,
W71-04185 05D

THE STRUCTURE AND MORPHOLOGY OF INORGANIC MEMBRANES,
W71-04224 03A

REVERSE OSMOSIS DESALTING STATE-OF-THE-ART (1969).
W71-04225 03A

MERCAPTANS
MICRODETERMINATION OF DERIVATIVES OF PHENOLS AND MERCAPTANS BY MEANS OF ELECTRON CAPTURE GAS CHROMATOGRAPHY,
W71-04218 05A

MERCURIC CHLORIDE
THE PRESERVATION OF PHYTOPLANKTON GRAB SAMPLES,
W71-04207 05A

MERTHIOLATE
THE PRESERVATION OF PHYTOPLANKTON GRAB SAMPLES,
W71-04207 05A

MESOSCALE WEATHER-SYSTEMS
ANALYSIS OF MESOSCALE SYSTEMS,
W71-04157 02B

METABOLISM
METABOLIC RESPONSE OF ACTIVATED SLUDGE TO SODIUM PENTACHLOROPHENOL,
W71-04088 05D

METAMORPHIC ROCKS
A GEOCHEMICAL TREND IN SILICON-ALUMINUM-IRON RATIOS AND THE CLASSIFICATION OF CLASTIC SEDIMENTS,
W71-03945 02K

METEOROLOGICAL INSTRUMENTS
UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME II. STATE-OF-THE-ART OF OCEANOGRAPHIC AND METEOROLOGICAL SENSORS, CATALOG,
W71-04010 07B

METEOROLOGICAL PARAMETERS
UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME I. STATE-OF-THE-ART OF OCEANOGRAPHIC AND METEOROLOGICAL SENSORS, TUTORIAL DISCUSSION,
W71-04009 07B

UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME III. THE SURVIVAL ENVIRONMENT FOR OCEANOGRAPHIC AND METEOROLOGICAL SENSORS,
W71-04011 07B

UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME IV. THE FORMATTING AND TRANSMISSION OF DATA FROM OCEANOGRAPHIC SENSORS,
W71-04012 07B

UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME V. ANALYSIS OF APPLYING STANDARDIZATION TECHNIQUES TO OCEANOGRAPHIC SENSORS,
W71-04013 07B

UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME VI. TEST REQUIREMENTS FOR OCEANOGRAPHIC AND METEOROLOGICAL SENSORS,
W71-04014 07B

METEOROLOGY
ANALYSIS OF MESOSCALE SYSTEMS,
W71-04157 02B

SOME RESULTS OF INVESTIGATION AND REPRESENTATION OF SNOW SUPPLY AND THE MELTING OF SNOW,
W71-04174 02C

METEROLOGY
CLOUD SEEDING POTENTIALITIES IN LOS ANGELES COUNTY.
W71-03903 03B

METHODOLOGY
WATER RESOURCES PLANNING IN THE URBAN-METROPOLITAN CONTEXT,
W71-03861 06B

SPECTROPHOTOMETRIC DETERMINATION OF CHLORATE ION,
W71-03994 02K

METROPOLITAN WATER RESOURCE MANAGEMENT
WATER RESOURCES PLANNING IN THE URBAN-METROPOLITAN CONTEXT,
W71-03861 06B

MICHIGAN
HANSON V BERT WAY ESTATE (RIPARIAN RIGHTS OF ADVERSE POSSESSOR).
W71-04315 06E

MICROBIAL ACTIVITY
MOVEMENT OF ALGAL- AND FUNGAL-BOUND RADIOSTRONTUM AS CHELATE COMPLEXES IN A CALCAREOUS SOIL,
W71-04067 05B

MICROBIAL POPULATIONS
MICROBIAL POPULATIONS IN STUBBLE-MULCHED SOIL,
W71-04068 02G

MICROEMULSIONS
STRUCTURE OF WATER IN MICROEMULSIONS ELECTRICAL, BIREFRINGENCE, AND NUCLEAR MAGNETIC RESONANCE STUDIES,
W71-04108 01B

MICROENVIRONMENT
STRUCTURE OF WATER IN MICROEMULSIONS ELECTRICAL, BIREFRINGENCE, AND NUCLEAR MAGNETIC RESONANCE STUDIES,
W71-04108 01B

ENVIRONMENTAL CONTROL OF COLORATION IN AN ACRIDID, GASTRIMARGUS AFRICANUS (SAUSSURE),
W71-04302 03F

MICROORGANISMS
MULTI-STAGE BIOLOGICAL PROCESSES FOR WASTE TREATMENT,
W71-03894 05D

MICROBIAL POPULATIONS IN STUBBLE-MULCHED SOIL,
W71-04068 02G

MICROSIPHONA POTAMOS
A NEW FRESHWATER CENTRIC DIATOM MICROSIPHONA POTAMOS GEN. ET

SP. NOV.,
W71-04193 05C

MINAS BASIN(NOVA SCOTIA)
DEPOSITIONAL AND DISPERSAL DYNAMICS OF INTERTIDAL SAND BARS,
W71-03948 02J

MINE ACIDS
MINE WASTE WATER PROBLEMS IN EUROPE,
W71-03898 05D

MINE DRAINAGE
STREAM POLLUTION BY COAL MINE DRAINAGE IN APPALACHIA.
W71-03873 05B

FEASIBILITY STUDY OF MINING COAL IN AN OXYGEN FREE ATMOSPHERE.
W71-04187 05G

TREATMENT OF ACID MINE DRAINAGE BY FOAM SEPARATION,
W71-04188 05D

NEUTRALIZATION OF HIGH FERRIC IRON ACID MINE DRAINAGE,
W71-04189 05D

MINE WASTES
STUDY OF WATER POLLUTION PROBLEMS WHICH AFFECT FISH AND OTHER AQUATIC FORMS,
W71-03852 05C

WASTE PROBLEMS RELATIVE TO MINING AND MILLING OF MOLYBDENUM,
W71-03888 05D

WASTE WATER RESULTING FROM THE CONCENTRATION OF LOW GRADE IRON ORE,
W71-04083 05D

MINERALOGY
MINERAL AND CHEMICAL COMPOSITION OF SEDIMENTS FROM THE STRAITS OF FLORIDA,
W71-03944 02J

CHEMICAL EXCHANGE BETWEEN SEA WATER AND DEEP OCEAN BASALTS,
W71-03956 02K

MINERALOGY OF SOME ARID AND SEMIARID LAND SOILS OF IRAQ,
W71-04061 02G

MINING ENGINEERING
FEASIBILITY STUDY OF MINING COAL IN AN OXYGEN FREE ATMOSPHERE.
W71-04187 05G

MISSISSIPPI
WILSON V ST REGIS PULP AND PAPER CORP (BOUNDARY LINE BETWEEN PROPERTIES LOCATED ON OPPOSITE SIDES OF STREAM).
W71-04317 06E

MISSISSIPPI RIVER BASIN
QUALITY OF SURFACE WATERS OF THE UNITED STATES, 1965 PARTS 7 AND 8. LOWER MISSISSIPPI RIVER BASIN AND WESTERN GULF OF MEXICO BASINS.
W71-04048 02K

MISSOURI
WYKLE V COLOMBO (APPORTIONMENT OF ACCRETIONS BETWEEN ADJACENT RIPARIAN OWNERS).
W71-04078 06E

THE BACKGROUND CONCENTRATIONS OF COPPER, LEAD, AND ZINC IN STREAMS OF THE 'NEW LEAD BELT', MISSOURI,
W71-04182 05A

WATER-USE LAW IN MISSOURI,
W71-04339 06E

MIXING
EFFECT OF DISPERSION, GRAVITATIONAL SEGREGATION, AND FORMATION STRATIFICATION ON THE RECOVERY OF FRESHWATER STORED IN SALINE AQUIFERS,
W71-03870 02F

MOBILE-BED STREAMS
HYDRAULIC CRITERIA OF STREAMS WITH A MOBILE BOTTOM,
W71-03965 02J

MODEL STUDIES
RESOURCE SYSTEMS MODELS IN DECISION MAKING,
W71-03856 06A

A REVIEW OF THE 1969 LITERATURE ON WASTE WATER AND WATER POLLUTION CONTROL, ADMINISTRATION SYSTEMS ANALYSIS,
W71-03879 05G

SYSTEM OPTIMIZATION FOR RIVER BASIN WATER QUALITY MANAGEMENT,
W71-03881 05G

NATURAL HAZARD IN HUMAN ECOLOGICAL PERSPECTIVE HYPOTHESES AND MODELS,
W71-04032 06G

MODELING AND OPTIMIZATION OF WATER RESOURCES SYSTEMS - PHASE I,
W71-04043 06A

HYDROGRAPH SYNTHESIS FOR WATERSHED SUBZONES FROM MEASURED URBAN PARAMETERS,
W71-04184 04C

MODEL WATER CODES
WATER QUALITY CONTROL A MODERN APPROACH TO STATE REGULATION,
W71-04101 06E

MOISTURE
LITERATURE SURVEY OF MOISTURE MIGRATION IN SOILS DUE TO THERMAL GRADIENTS,
W71-04000 02C

MOISTURE AVAILABILITY
LEAF SAMPLER FOR RELATIVE WATER CONTENT MEASUREMENTS DESIGN AND APPLICATION,
W71-04239 02I

MOISTURE CONTENT
EMPIRICAL RELATIONSHIPS BETWEEN MASS PHYSICAL PROPERTIES FOR RECENT MARINE SEDIMENTS OFF SOUTHERN CALIFORNIA,
W71-03951 02J

LEAF SAMPLER FOR RELATIVE WATER CONTENT MEASUREMENTS DESIGN AND APPLICATION,
W71-04239 02I

MOISTURE STRESS
MEASUREMENT OF WATER POTENTIAL WITH THERMOCOUPLE PSYCHROMETERS CONSTRUCTION AND APPLICATIONS,
W71-04237 02I

WATER POTENTIAL MEASUREMENTS IN TRESS,
W71-04238 02I

LEAF SAMPLER FOR RELATIVE WATER CONTENT MEASUREMENTS DESIGN AND APPLICATION,
W71-04239 02I

MOISTURE TENSION
MEASUREMENT OF WATER POTENTIAL WITH THERMOCOUPLE PSYCHROMETERS CONSTRUCTION AND APPLICATIONS,
W71-04237 02I

WATER POTENTIAL MEASUREMENTS IN TRESS,
W71-04238 02I

LEAF SAMPLER FOR RELATIVE WATER CONTENT MEASUREMENTS DESIGN AND APPLICATION,
W71-04239 02I

MOLE DRAINAGE
MOLE DRAINAGE,
W71-04008 08A

MOLYBDENUM
WASTE PROBLEMS RELATIVE TO MINING AND MILLING OF MOLYBDENUM,
W71-03888 05D

STUDY OF MOLYBDENUM IN PUBLIC WATER SUPPLY,
W71-04120 05A

MONITORING
COST OF PATUXENT RIVER QUALITY MONITORING,
W71-04115 05A

MONOMOLECULAR FILMS
SURFACE CHEMISTRY STUDIES ON THE BAY OF PANAMA,
W71-04001 02L

MONSOONS
ENVELOPE-FREQUENCY RELATIONS FOR MAXIMUM FLOODS IN MONSOON AREAS OF THE ECAFE REGION.
W71-04117 02B

QUANTITATIVE REGIONAL PREDICTION OF RAINFALL IN ECAFE REGIONS,
W71-04152 02B

VERTICAL VELOCITY AND RAINFALL COMPUTATION,
W71-04153 02B

RAIN FROM TROPICAL CYCLONES AND TROUGH-TYPE SYSTEMS,
W71-04156 02B

LOWER AND MIDDLE IRRAWADDY FLOODS IN RELATION TO HEAVY RAINFALL IN THE HEAD WATER REGIONS OF CHINDWIN AND IRRAWADDY RIVERS,
W71-04165 02E

SOME EXAMPLES OF HEAVY RAINFALL IN JAPAN,
W71-04166 02B

THE PROBLEM OF FLOOD PREDICTION ON THE EAST COAST OF WEST MALAYSIA,
W71-04167 02B

HEAVY RAINFALL IN PAKISTAN AND ITS ASSOCIATED FLOOD,
W71-04168 02B

HEAVY RAINFALL AND ASSOCIATED FLOODS IN WEST PAKISTAN,
W71-04169 02B

THE CIRCULATION PATTERN OVER SINGAPORE AND THE EAST COAST OF WEST MALAYSIA DURING JANUARY AND FEBRUARY 1967 COMPARED WITH THAT OF JANUARY AND FEBRUARY 1968,
W71-04170 02B

THE CLIMATE OF INTERIOR OMAN,
W71-04227 02B

MONTHLY
SUPERPOSITION OF SUBMONTHLY FLOWS IN STOCHASTIC HYDROLOGY,
W71-04040 02E

MOSTURE INDEX
A NEW APPROACH TO THE CLASSIFICATION OF CLIMATE,
W71-04235 02B

MOUNTAIN STREAM HYDRAULICS
HYDRAULIC RESISTANCE AND FORMULA FOR COMPUTING THE AVERAGE FLOW VELOCITY OF MOUNTAIN RIVERS,
W71-03961 02E

MOVEMENT
SOME FEATURES OF THE MECHANICS OF GLACIER MOVEMENT,
W71-03972 02C

MUDFLOW CLASSIFICATION
SOME ASPECTS OF THE FORMATION OF MUDFLOWS AND METHODS OF COMPUTING THEM,
W71-03963 02J

MUDFLOW CONTROL
MUD FLOWS AND FLOODS AND THEIR CONTROL,
W71-03970 02J

MUDFLOWS
SOME ASPECTS OF THE FORMATION OF MUDFLOWS AND METHODS OF COMPUTING THEM,
W71-03963 02J

MUD FLOWS AND FLOODS AND THEIR CONTROL,
W71-03970 02J

MULTIPLE EFFECT DISTILLATION
SECOND REPORT ON HORIZONTAL-TUBE MULTIPLE-EFFECT PROCESS PILOT PLANT TESTS AND DESIGN,
W71-04220 03A

MULTIPLE-PURPOSE PROJECTS
NATURE'S LAW AND MAN'S ETHIC,
W71-04069 04C

MULTIPLE-PURPOSE RESERVOIR
A NONLINEAR MULTIPLE RESERVOIR WATER RESOURCES MODEL WITH MULTIPLE PURPOSES,
W71-04044 04A

MULTIPLE-PURPOSE RESERVOIRS
APPLYING GRADIENT PROJECTION AND CONJUGATE GRADIENT TO THE OPTIMUM OPERATION OF RESERVOIRS,
W71-04030 04A

OPTIMUM OPERATION OF MULTIPLE RESERVOIRS WITH MULTIPLE PURPOSES,
W71-04046 04A

MULTI-STAGE DIGESTION
MULTI-STAGE BIOLOGICAL PROCESSES FOR WASTE TREATMENT,
W71-03894 05D

MUNICIPAL WASTES
SANTEE PROJECT CONTINUES TO SHOW THE WAY,
W71-03904 05D

ARTIFICIAL SUBSTRATE SAMPLING, MACROINVERTEBRATES IN A POLLUTED REACH OF THE KLAMATH RIVER, OREGON,
W71-04191 05A

MUNICIPAL WATER
A STUDY OF WATER USE IN SINGLE-DWELLING RESIDENCES IN THE CITY OF CALGARY, ALBERTA, ALBERTA UNIV., EDMONTON (CANADA),
W71-04287 03D

NATIONAL ENVIRONMENTAL POLICY ACT
A NATIONAL POLICY FOR THE ENVIRONMENT SELECTED EXCERPTS FROM THE CONGRESSIONAL RECORD AND CONGRESSIONAL DOCUMENTS, FALL, 1969, 91ST CONGRESS. 1ST SESSION.
W71-04092 06E

NATURAL FLOW
HANOVER DRAINAGE AND LEVEE DIST V SANTA FE DRAINAGE AND LEVEE DIST (DRAINAGE DISTRICT'S AUTHORITY TO REMOVE NATURAL BARRIER AND CHANGE DIRECTION OF DRAINAGE FLOW).
W71-04246 06E

NATURAL FLOW DOCTRINE
BOOBER V TOWNE (ROAD DEPARTMENT'S LIABILITY FOR INCREASING THE FLOW OF WATER OVER CONTIGUOUS LAND).
W71-04333 06E

NATURAL RESOURCES
NATURAL RESOURCE SYSTEMS MODELS IN DECISION MAKING.
W71-03855 06A

INTERACTION AMONG NATURAL RESOURCE SYSTEMS, THE DECISION MAKERS AND THE PUBLIC IN THE 2000'S,
W71-03868 06B

DEVELOPMENT OF OCEAN SPACE--AN INTERNATIONAL DILEMMA,
W71-04098 06E

CONTINENTAL SHELF LAW OUTDISTANCED BY SCIENCE AND TECHNOLOGY,
W71-04100 06E

AN ECOLOGICAL CRITERION FOR EVALUATING AN ENVIRONMENT,
W71-04274 06B

NAVIGABLE RIVERS
IN RE ROMA (ABILITY OF UPLAND OWNER TO ACQUIRE TITLE TO SUBMERGED LANDS BY ADVERSE POSSESSION).
W71-04146 06E

STATE V PLANT (VIOLATION OF STATUTE PROHIBITING OPERATION OF BOAT FOR HUNTING DURING CERTAIN HOURS).
W71-04320 06E

NAVIGABLE WATERS
FEDERAL ENFORCEMENT UNDER THE REFUSE ACT OF 1899,
W71-04102 06E

DUCK ISLAND HUNTING AND FISHING CLUB V EDWARD GILLEN DOCK, DREDGE AND CONSTRUCTION CO (DISSOLUTION OF DRAINAGE DISTRICT).
W71-04277 06E

PEOPLE V TRUSTEES OF FREEHOLDERS (VALIDITY OF PRE-STATEHOOD PATENTS TO BEDS UNDER NAVIGABLE WATERS).
W71-04328 06E

WHITE V STATE (VALIDITY OF GRANT OF SUBMERGED STATE LANDS).
W71-04350 06E

NAVIGATION
STATE V PLANT (VIOLATION OF STATUTE PROHIBITING OPERATION OF BOAT FOR HUNTING DURING CERTAIN HOURS).
W71-04320 06E

IN RE WATERFRONT OF CITY OF NEW YORK (RIPARIAN RIGHTS SUBJECT TO PUBLIC RIGHT TO IMPROVE NAVIGATION).
W71-04323 06E

NEBRASKA
PEDOGENIC DISTRIBUTION OF ZINC IN MOLLISOLS AND ASSOCIATED ENTISOLS IN NEBRASKA,
W71-03940 02G

MICROBIAL POPULATIONS IN STUBBLE-MULCHED SOIL,
W71-04068 02G

NETWORK DESIGN
A CONTRIBUTION TO THE PROBLEM OF SPACING RAINGAUGES IN RUGGED TERRAIN,
W71-04122 07A

ANALYSIS OF RAINFALL OVER A SMALL AREA,
W71-04155 02B

NEUTRALIZATION
NEUTRALIZATION OF HIGH FERRIC IRON ACID MINE DRAINAGE,
W71-04189 05D

NEVADA
FLOOD PLAIN INFORMATION, TRUCKEE RIVER, RENO-SPARKS-TRUCKEE MEADOWS, NEVADA.
W71-04144 04A

NEW JERSEY
INFORMATION FOR APPLICANTS FOR CONSTRUCTION, ALTERATION, OR REPAIR OF DAMS.
W71-04094 06E

JACOBS V ELWELL (RIGHT TO PREVENT CONSTRUCTION ON BEACH).
W71-04318 06E

NEW LEAD BELT(MISSOURI)
THE BACKGROUND CONCENTRATIONS OF COPPER, LEAD, AND ZINC IN STREAMS OF THE 'NEW LEAD BELT', MISSOURI,
W71-04182 05A

NEW YORK
IN RE CITY OF YONKERS (CONDEMNATION VALUE OF RIPARIAN LAND).
W71-03883 06E

A PROPOSED STREAMFLOW DATA PROGRAM FOR NEW YORK,
W71-03933 07A

MENTELSON V STATE (LIABILITY FOR FLOOD DAMAGE RESULTING FROM STATE'S OBSTRUCTION OF DRAINAGE CHANNEL).
W71-04018 06E

HYDRAULIC RACE CO V GREENE (INTERPRETATION OF LEASE PROVIDING FOR USE OF ALL SURPLUS WATERS OF CANAL).
W71-04074 06E

IN RE ROMA (ABILITY OF UPLAND OWNER TO ACQUIRE TITLE TO SUBMERGED LANDS BY ADVERSE POSSESSION).
W71-04146 06E

LITTLE FALLS FIBRE CO V HENRY FORD AND SON, INC (FLASHBOARDS REDUCING RIPARIAN OWNER'S POWER HEAD).
W71-04203 06E

BAY RIDGE DOCK CO V UNITED DRY DOCKS, INC (RIGHT TO FILL TO BULKHEAD LINE INCLUDES RIGHT TO MAINTAIN FLOATING DRY DOCK).
W71-04245 06E

HUNTER V VAN KEUREN (BOUNDARY DISPUTE AT LAKESHORE).
W71-04276 06E

TOWN OF PERU V STATE (COMPENSATION FOR STATE'S APPROPRIATION OF TOWN'S DOCK).
W71-04310 06E

PEOPLE V PORT OF NEW YORK AUTHORITY (REMEDY FOR POLLUTION OF STATE PROPERTY).
W71-04311 06E

WEST SHORE RR V STATE (LIABILITY FOR APPROPRIATION OF RIVER FLOW FOR NEW CHANNEL OUTSIDE RIVER).
W71-04321 06E

WIESNER V CITY OF ALBANY (MUNICIPAL LIABILITY FOR TYPHOID EPIDEMIC CAUSED BY DEFECTIVE PIPELINE).
W71-04322 06E

IN RE WATERFRONT OF CITY OF NEW YORK (RIPARIAN RIGHTS SUBJECT TO PUBLIC RIGHT TO IMPROVE NAVIGATION).
W71-04323 06E

PEOPLE V TRUSTEES OF FREEHOLDERS (VALIDITY OF PRE-STATEHOOD PATENTS TO BEDS UNDER NAVIGABLE WATERS).
W71-04328 06E

OYSTERMEN'S DOCK COMPANY V DOWNING (LAND UNDER TIDAL WATERS HELD IN PUBLIC TRUST).
W71-04329 06E

PEOPLE EX REL WESTERN NEW YORK AND P RY V STATE TAX COMM'N (ASSESSMENT OF RAILROAD BRIDGE AS A SPECIAL FRANCHISE).
W71-04342 06E

IN RE LANDS ON UPPER NEW YORK BAY (EASEMENT IN SUBMERGED LANDS EXTINGUISHED BY RESOLUTION OF MUNICIPAL COUNCIL).
W71-04347 06E

PEOPLE V ZORA REALTY CO (ATTEMPT TO DECLARE PATENT IN SUBMERGED LANDS VOID FOR NONUSE).
W71-04348 06E

IN RE INWOOD HILL PARK (CONDEMNATION OF CITY'S OWN LAND FOR PARK).
W71-04349 06E

NEW YORK STATE'S PPB SYSTEM
ASPECTS OF PLANNING, EVALUATION, AND DECISION-MAKING IN SPORT FISHERY MANAGEMENT.
W71-04271 06B

NEW ZEALAND
THE RELATIONSHIP BETWEEN SUMMER LOW FLOWS AND GEOLOGY IN NORTHLAND, NEW ZEALAND,
W71-03931 02A

A CONTRIBUTION TO THE PROBLEM OF SPACING RAINGAUGES IN RUGGED TERRAIN,
W71-04122 07A

NIGER
SOME ASPECTS OF THE GEOMORPHOLOGY OF THE AIR MOUNTAINS, SOUTHERN SAHARA,
W71-04050 02G

NIGERIA
FARMING, FOREST AND SAVANNA IN WESTERN NIGERIA,
W71-04054 03F

NILE RIVER
THE LOCATION OF LAND USE TYPES THE NILE VALLEY IN NORTHERN SUDAN,
W71-04228 04A

NITROGEN
EVALUATION OF IRRIGATION WATER AND NITROGEN FERTILIZER IN CORN PRODUCTION,
W71-04304 03F

NOMADISM
THE LOCATION OF LAND USE TYPES THE NILE VALLEY IN NORTHERN SUDAN,
W71-04228 04A

NONLINEAR PROGRAMMING
APPLYING GRADIENT PROJECTION AND CONJUGATE GRADIENT TO THE OPTIMUM OPERATION OF RESERVOIRS,
W71-04030 04A

A NONLINEAR MULTIPLE RESERVOIR WATER RESOURCES MODEL WITH MULTIPLE PURPOSES,
W71-04044 04A

NONLINEAR SYSTEM
OPTIMAL ALLOCATION OF STOCHASTIC WATER SUPPLY,
W71-04028 03B

NON-LINEAR PROGRAMMING
A QUANTITATIVE FRAMEWORK FOR RESIDUALS--ENVIRONMENTAL QUALITY MANAGEMENT,
W71-03858 05G

NON-STRUCTURAL ALTERNATIVES
WATER RIGHTS LAW AND MANAGEMENT IN WEST VIRGINIA -- FUTURE NEEDS AND ALTERNATIVES,
W71-03880 06E

THE POLITICS OF WATER,
W71-04091 06E

NON-WETTABLE SOILS
INFILTRATION AND SOIL EROSION ON COOLWATER RIDGE, IDAHO,
W71-04261 02J

NORTH CAROLINA
DUNBAR V BD OF COMM'RS OF ALBEMARLE DRAINAGE DIST (FAILURE OF DRAINAGE DISTRICT TO ERECT DAM CAUSES CROP FLOODING).
W71-04345 06E

NORTH SEA
TIDAL SAND MOVEMENT BETWEEN SOME LINEAR SAND BANKS IN THE NORTH SEA OFF NORTHEAST NORFOLK,
W71-03953 02J

NORTHERN GREAT PLAINS
AN ECONOMIC ANALYSIS OF LEVEL BENCH SYSTEMS FOR FORAGE PRODUCTION IN NORTH DAKOTA,
W71-04265 03F

NUCLEAR ENERGY
FLORIDA FIRM USES GAMMA RAYS TO POLISH SEWAGE PLANT EFFLUENT.
W71-03890 05D

NUCLEAR MOISTURE METERS
HALF-MINUTE COUNTS FOR NEUTRON PROBES,
W71-04259 07B

NUCLEAR POWER PLANTS
DRY LANDS AND A HUNGRY WORLD,
W71-04291 06B

NUCLEAR POWERPLANTS
BOLSA ISLAND NUCLEAR POWER AND DESALTING PROJECT FACILITIES (COST AND DESCRIPTION) AND COST OF DESALTED WATER,
W71-03915 03A

NUTRIENT REMOVAL
RESPIRATORY RELATIONSHIPS OF A SYMBIOTIC ALGAL-BACTERIAL CULTURE FOR WASTE WATER NUTRIENT REMOVAL,
W71-04079 05D

NUTRIENTS
EUTROPHICATION OF WATER RESOURCES OF NEW YORK STATE, OBSERVATIONS ON NUTRIENT LIMITATION ON SUMMER PHYTOPLANKTON IN CAYUGA LAKE, 1967 AND 1968,
W71-03923 02H

NUYAKA CREEK FLOOD PLAIN(OKLAHOMA)
USING COMPUTERS TO HELP EVALUATE FLOOD PROTECTION MEASURES,
W71-04293 07C

OASES
FEEDING A DESERT CITY ANTOFAGASTA, CHILE,
W71-04055 03F

OASIS EFFECT
PROBLEMS OF DETERMINING EVAPOTRANSPIRATION IN THE SEMI-ARID TROPICS ILLUSTRATED WITH REFERENCE TO THE SUDAN,
W71-04236 02D

OBSERVATION WELLS
REMOTE GROUNDWATER LEVEL METER FOR BOG STATIONS,
W71-03966 07B

OCEAN CURRENTS
TIDAL SAND MOVEMENT BETWEEN SOME LINEAR SAND BANKS IN THE NORTH SEA OFF NORTHEAST NORFOLK,
W71-03953 02J

OCEAN RESOURCES
DEVELOPMENT OF OCEAN SPACE--AN INTERNATIONAL DILEMMA,
W71-04098 06E

TOWARDS A BETTER USE OF THE OCEAN CONTEMPORARY LEGAL PROBLEMS IN OCEAN DEVELOPMENT,
W71-04338 06E

OCEANIC BASALTS
CHEMICAL EXCHANGE BETWEEN SEA WATER AND DEEP OCEAN BASALTS,
W71-03956 02K

OCEANOGRAPHIC DATA
UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME I. STATE-OF-THE-ART OF OCEANOGRAPHIC AND METEOROLOGICAL SENSORS, TUTORIAL DISCUSSION,
W71-04009 07B

UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME II. STATE-OF-THE-ART OF OCEANOGRAPHIC AND METEOROLOGICAL SENSORS, CATALOG,
W71-04010 07B

UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME III. THE SURVIVAL ENVIRONMENT FOR OCEANOGRAPHIC AND METEOROLOGICAL SENSORS,
W71-04011 07B

UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME IV. THE FORMATTING AND TRANSMISSION OF DATA FROM OCEANOGRAPHIC SENSORS,
W71-04012 07B

UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME V. ANALYSIS OF APPLYING STANDARDIZATION TECHNIQUES TO OCEANOGRAPHIC SENSORS,
W71-04013 07B

UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME VI. TEST REQUIREMENTS FOR OCEANOGRAPHIC AND METEOROLOGICAL SENSORS,
W71-04014 07B

OCEANS
SURFACE CHEMISTRY STUDIES ON THE BAY OF PANAMA,
W71-04001 02L

DEVELOPMENT OF OCEAN SPACE--AN INTERNATIONAL DILEMMA,
W71-04098 06E

REORGANIZATION PLANS NOS. 3 AND 4 OF 1970.
W71-04326 06E

TOWARDS A BETTER USE OF THE OCEAN CONTEMPORARY LEGAL PROBLEMS IN OCEAN DEVELOPMENT,
W71-04338 06E

ODOR
A CASE STUDY OF MICROORGANIC CONTAMINANTS IN RIVER WATER,

W71-04119 05A

OHIO
PRINCIPLES OF WATER RIGHTS LAW IN OHIO,
W71-04022 06E

CITY OF SALEM V HARDING (CITY'S NEGLIGENCE IN CAUSING ILLNESS BY CONTAMINATION OF WATER SUPPLY).
W71-04278 06E

BAUMHART V MCCLURE (OWNERSHIP OF RIPARIAN LAND AFTER SUSTAINED SUBMERGENCE).
W71-04330 06E

OHIO RIVER
PERIPHYTON BIOMASS-CHLOROPHYLL RATIO AS AN INDEX OF WATER QUALITY,
W71-04206 05A

USING MACROINVERTEBRATE COLLECTIONS FOR WATER QUALITY MONITORING IN THE OHIO RIVER BASIN 1963-1966,
W71-04208 05C

OIL INDUSTRY
OFFSHORE OIL SPILLS AN EVALUATION OF RECENT UNITED STATES RESPONSES,
W71-04305 06E

OIL SPILLS
OFFSHORE OIL SPILLS AN EVALUATION OF RECENT UNITED STATES RESPONSES,
W71-04305 06E

OIL-WATER INTERFACES
STRUCTURE OF WATER IN MICROEMULSIONS ELECTRICAL, BIREFRINGENCE, AND NUCLEAR MAGNETIC RESONANCE STUDIES,
W71-04108 01B

OKLAHOMA
ALTERNATIVE CROP ENTERPRISE BUDGETS FOR IRRIGATED PRODUCTION, SOUTHWESTERN OKLAHOMA,
W71-04294 03F

OMAN
THE CLIMATE OF INTERIOR OMAN,
W71-04227 02B

OMAN CONVERGENCE ZONE
THE CLIMATE OF INTERIOR OMAN,
W71-04227 02B

ON-SITE TESTS
WETTING AGENT FAILS TO CURB EROSION FROM BURNED WATERSHED,
W71-04250 04D

OPEN CHANNEL FLOW
HYDRAULIC RESISTANCE AND FORMULA FOR COMPUTING THE AVERAGE FLOW VELOCITY OF MOUNTAIN RIVERS,
W71-03961 02E

INFLUENCE OF THE BANKS AND FLOOD PLAIN ON CHANNEL CONVEYANCE,
W71-03968 02E

THE TRAPEZOIDAL FREE OVERFALL,
W71-04128 08B

OPERATIONS RESEARCH
PROCEEDINGS OF A SEMINAR ON RESERVOIR SYSTEMS ANALYSIS, 4-6 NOVEMBER 1969.
W71-04034 04A

OPTIMIZATION
A QUANTITATIVE FRAMEWORK FOR RESIDUALS--ENVIRONMENTAL QUALITY MANAGEMENT,
W71-03858 05G

THE EVALUATION OF THE COST OF ALTERNATIVE STRATEGIES FOR AIR POLLUTION CONTROL,
W71-03859 06A

PLANNING FOR THE OSWEGO BASIN IN NEW YORK--A SYSTEMS APPROACH,
W71-03860 06A

SYSTEM OPTIMIZATION FOR RIVER BASIN WATER QUALITY MANAGEMENT,
W71-03881 05G

WATER RESOURCES SYSTEMS ENGINEERING,
W71-03885 06A

GROUNDWATER STORAGE CONTROL UNDER INSTITUTIONAL RESTRICTIONS,
W71-04024 04B

DESIGN CAPACITIES TO ACCOMMODATE FORECAST UNDERTAINTIES,
W71-04026 06A

OPTIMAL ALLOCATION OF STOCHASTIC WATER SUPPLY,
W71-04028 03B

APPLYING GRADIENT PROJECTION AND CONJUGATE GRADIENT TO THE OPTIMUM OPERATION OF RESERVOIRS,
W71-04030 04A

OPTIMIZATION FOR PLANNING AND LOCATION OF PRECIPITATION STATIONS IN THE JEMEZ MOUNTAINS,
W71-04033 06A

REPLY,
W71-04035 06E

AN APPROACH TO FINDING RESERVOIR RULES FOR POWER OPTIMIZATION,
W71-04037 04A

OPTIMIZATION OF WATER RESOURCE SYSTEMS INCORPORATING EARTHQUAKE RISK PROGRESS REPORT NO 1,
W71-04041 06A

OPTIMAL OPERATION OF WATER SUPPLY SYSTEMS,
W71-04042 04B

MODELING AND OPTIMIZATION OF WATER RESOURCES SYSTEMS - PHASE I,
W71-04043 06A

A NONLINEAR MULTIPLE RESERVOIR WATER RESOURCES MODEL WITH MULTIPLE PURPOSES,
W71-04044 04A

OPTIMUM OPERATION OF MULTIPLE RESERVOIRS WITH MULTIPLE PURPOSES,
W71-04046 04A

OPTIMIZATION OF WATER RESOURCES SYSTEMS BY THE GRADIENT PROJECTION METHOD,
W71-04047 06A

OPTIMUM FIRE POWER OUTPUT FROM A TWO RESERVOIR SYSTEM BY INCREMENTAL DYNAMIC PROGRAMMING,
W71-04111 04A

OPTIMUM DEVELOPMENT PLANS
NATURE'S LAW AND MAN'S ETHIC,
W71-04069 04C

ORANGES
ROOTSTOCKS FOR VALENCIA ORANGES AND LIBSON LEMONS IN ARIZONA,
W71-04059 03F

ORGANIC CARBON
PHYTOPLANKTON, SESTON, AND DISSOLVED ORGANIC CARBON IN THE LITTLE MIAMI RIVER AT CINCINNATI, OHIO,
W71-04209 05A

ORGANIC MATTER
THE PERIODIC CYCLE OF PARTICULATE MATTER IN A SHALLOW, TEMPERATE ESTUARY,
W71-03943 02L

ORGANOPHOSPHORUS PESTICIDES
PESTICIDES IN SURFACE WATERS OF THE UNITED STATES A FIVE-YEAR SUMMARY 1964-1968,
W71-04201 05A

ORTHOPHOSPHATES
METHOD SELECTION STUDY 1 A COMPARISON OF THREE MODIFICATIONS OF THE SINGLE REAGENT METHOD FOR SOLUBLE ORTHOPHOSPHATE,
W71-04204 05A

OSMOSIS
POROUS TUBULET SUPPORTS FOR DESALINATION BARRIERS,
W71-03911 03A

WATER TRANSPORT THROUGH PLASTICIZED MEMBRANES,
W71-03912 03A

IMPROVING EFFICIENCY IN AGRICULTURAL WATER USE.
W71-04049 03C

MEMBRANE MATERIALS FOR WASTE WATER RECLAMATION BY REVERSE OSMOSIS,
W71-04185 05D

REVERSE OSMOSIS DESALTING STATE-OF-THE-ART (1969).
W71-04225 03A

OVERFALLS
THE TRAPEZOIDAL FREE OVERFALL,
W71-04128 08B

OVERFALLS(TRAPEZOIDAL)
THE TRAPEZOIDAL FREE OVERFALL,
W71-04128 08B

OWNERSHIP OF BEDS
IN RE ROMA (ABILITY OF UPLAND OWNER TO ACQUIRE TITLE TO SUBMERGED LANDS BY ADVERSE POSSESSION).
W71-04146 06E

PARKS V PENNSYLVANIA RR (TITLE TO LAND PREVIOUSLY FLOOD BY BACKWATER).
W71-04243 06E

PEOPLE V TRUSTEES OF FREEHOLDERS (VALIDITY OF PRE-STATEHOOD PATENTS TO BEDS UNDER NAVIGABLE WATERS).
W71-04328 06E

OYSTERMEN'S DOCK COMPANY V DOWNING (LAND UNDER TIDAL WATERS HELD IN PUBLIC TRUST).
W71-04329 06E

POST V WILKES-BARRE CONNECTING RR (DESCRIPTION OF CHANNEL AS PROPERTY BOUNDARY WHERE BED LATER DRIES UP).
W71-04346 06E

PEOPLE V ZORA REALTY CO (ATTEMPT TO DECLARE PATENT IN SUBMERGED LANDS VOID FOR NONUSE).

W71-04348 06E

WHITE V STATE (VALIDITY OF GRANT OF SUBMERGED STATE LANDS).
W71-04350 06E

OXALATE
SPECTROPHOTOMETRIC DETERMINATION OF THIOCYANATE AND OXALATE,
W71-03928 05A

OXIDATION LAGOONS
DESIGN CONSTRUCTION AND MAINTENANCE OF WASTE STABILIZATION LAGOONS,
W71-03896 05D

ENGINEERING FEASIBILITY DEMONSTRATION STUDY FOR MUSKEGON COUNTY, MICHIGAN, WASTE WATER TREATMENT-IRRIGATION SYSTEM.
W71-04186 05D

OXYGEN
VARIATION OF THE TRITIUM AND OXYGEN-18 CONTENT IN PRECIPITATION AND SNOWPACK IN A REPRESENTATIVE BASIN IN CZECHOSLOVAKIA,
W71-04135 02A

QUANTITATIVE ASPECTS OF THE STUDY OF WATER BALANCES IN LAKES USING THE DEUTERIUM AND OXYGEN-18 CONCENTRATIONS IN THE WATER, (FRENCH),
W71-04139 02A

ENVIRONMENTAL ISOTOPE BALANCE OF LAKE TIBERIAS,
W71-04140 02A

STABLE ISOTOPES IN STUDY OF WATER BALANCE OF LAKE NEUSIEDL, AUSTRIA INVESTIGATION OF THE RELIABILITY OF THE STABLE ISOTOPE METHOD,
W71-04141 02A

OXYGEN ISOTOPES
VARIATION OF THE TRITIUM AND OXYGEN-18 CONTENT IN PRECIPITATION AND SNOWPACK IN A REPRESENTATIVE BASIN IN CZECHOSLOVAKIA,
W71-04135 02A

QUANTITATIVE ASPECTS OF THE STUDY OF WATER BALANCES IN LAKES USING THE DEUTERIUM AND OXYGEN-18 CONCENTRATIONS IN THE WATER, (FRENCH),
W71-04139 02A

OXYGEN REQUIREMENTS
ENGINEERING ASPECTS OF SURFACE AERATION DESIGN,
W71-04073 05D

OXYGEN TRANSFER
ENGINEERING ASPECTS OF SURFACE AERATION DESIGN,
W71-04073 05D

PAKISTAN
HEAVY RAINFALL IN PAKISTAN AND ITS ASSOCIATED FLOOD,
W71-04168 02B

HEAVY RAINFALL AND ASSOCIATED FLOODS IN WEST PAKISTAN,
W71-04169 02B

PANAMA BAY
SURFACE CHEMISTRY STUDIES ON THE BAY OF PANAMA,
W71-04001 02L

PARATHION
PESTICIDES IN SURFACE WATERS OF THE UNITED STATES A FIVE-YEAR SUMMARY 1964-1968,
W71-04201 05A

PARTIALLY SATURATED FLOW
SIMILITUDE CONCEPT IN PARTIALLY SATURATED SOILS,
W71-04131 02G

PARTICLE SIZE
COMPARISON OF THE DESCRIPTORS OF SEDIMENT GRAIN-SIZE DISTRIBUTIONS,
W71-03947 02J

EMPIRICAL RELATIONSHIPS BETWEEN MASS PHYSICAL PROPERTIES FOR RECENT MARINE SEDIMENTS OFF SOUTHERN CALIFORNIA,
W71-03951 02J

PARTICLE SIZE DISTRIBUTIONS
COMPARISON OF THE DESCRIPTORS OF SEDIMENT GRAIN-SIZE DISTRIBUTIONS,
W71-03947 02J

PATENTS(LAND)
PEOPLE V TRUSTEES OF FREEHOLDERS (VALIDITY OF PRE-STATEHOOD PATENTS TO BEDS UNDER NAVIGABLE WATERS).
W71-04328 06E

PATH OF POLLUTANTS
MOVEMENT OF AGRICULTURAL POLLUTANTS WITH GROUNDWATER,
W71-04121 05B

ACCUMULATION OF PHOSPHATES IN WATER,
W71-04216 05B

PATULIN
MICROBIAL POPULATIONS IN STUBBLE-MULCHED SOIL,
W71-04068 02G

PATUXENT RIVER(MD)
COST OF PATUXENT RIVER QUALITY MONITORING,
W71-04115 05A

PEAK DISCHARGE
DETERMINATION OF THE DISTRIBUTION OF RAINFALL FLOODS IN LARGE CATCHMENTS USING HYDROMETEOROLOGICAL DATA,
W71-03977 02E

DETERMINATION OF MAXIMUM FLOOD FLOW AND THE PROBABILITY OF ITS BEING EXCEEDED, USING INCOMPLETE INFORMATION (FRENCH),
W71-03979 02E

EVALUATION OF MAXIMUM FLOW OF FLOODS USING PRECIPITATION DATA (FRENCH),
W71-03983 02A

DETERMINATION OF MAXIMUM FLOW AND FLOOD HYDROGRAPHS (FRENCH),
W71-03985 02E

MAXIMUM DISCHARGE OF MAJOR RIVERS IN LARGE FLOOD PLAINS IN EAST PAKISTAN,
W71-03986 02E

DO CONTOUR TRENCHES REDUCE WET-MANTLE FLOOD PEAKS,
W71-04262 04A

PENICILLIUM
MICROBIAL POPULATIONS IN STUBBLE-MULCHED SOIL,
W71-04068 02G

PENMAN METHOD
PROBLEMS OF DETERMINING EVAPOTRANSPIRATION IN THE SEMI-ARID TROPICS ILLUSTRATED WITH REFERENCE TO THE SUDAN,
W71-04236 02D

PENMAN'S FORMULA
AGROMETEOROLOGY SURVEY OF THE HIGHLANDS OF EASTERN AFRICA,
W71-04062 02D

PENNSYLVANIA
PARKS V PENNSYLVANIA RR (TITLE TO LAND PREVIOUSLY FLOOD BY BACKWATER).
W71-04243 06E

LEHIGH AND WILKES-BARRE COAL MINING CO V PITTSTON COAL MINING CO (DISCHARGE OF HYDRAULIC MINING WATER INTO CONTIGUOUS MINE).
W71-04332 06E

APPEAL OF PHILADELPHIA FELT CO (CONDEMNATION VALUE OF RIPARIAN LAND).
W71-04334 06E

POST V WILKES-BARRE CONNECTING RR (DESCRIPTION OF CHANNEL AS PROPERTY BOUNDARY WHERE BED LATER DRIES UP).
W71-04346 06E

PERCH LAKE(ONTARIO)
PERCH LAKE EVAPORATION STUDY,
W71-04142 02A

PERENNATION
PERENNATION IN ASTRAGALUS LENTIGINOSUS AND TRIDENS PULCHELLUS IN RELATION TO RAINFALL,
W71-04299 02I

PERENNIAL GRASS COVER
THE SAM SIMON WATERSHED SHRUB CONTROL,
W71-04058 03F

PERENNIAL PLANTS
ECOLOGICAL SIGNIFICANCE OF ALIEN PLANTS IN CALIFORNIA GRASSLANDS,
W71-04233 04A

PERIPHYTON
THE EVALUATION OF ENVIRONMENTAL ALTERATION BY THERMAL LOADING AND ACID POLLUTION IN THE COOLING RESERVOIR OF A STEAM-ELECTRIC STATION,
W71-04019 05C

USE OF A FLOATING PERIPHYTON SAMPLER FOR WATER POLLUTION SURVEILLANCE,
W71-04194 05B

METHODS OF COLLECTION AND ANALYSIS OF PLANKTON AND PERIPHYTON SAMPLES IN THE WATER POLLUTION SURVEILLANCE SYSTEM,
W71-04195 05A

PERMEABILITY
USE OF PORE CASTS AND SCANNING ELECTRON MICROSCOPE TO STUDY PORE GEOMETRY,
W71-03946 07B

DETERMINATION OF SOIL PERMEABILITY BY THE METHOD OF LARGE RINGS,
W71-04006 02G

NEW CHART OFFERS FAST PERMEABILITY ESTIMATE,
W71-04110 07B

PERMITS
CORCORAN V VILLAGE OF BENNINGTON (RIGHT TO WATER AND SEWER SERVICE PERMITS).
W71-04071 06E

INFORMATION FOR APPLICANTS FOR CONSTRUCTION, ALTERATION, OR REPAIR OF DAMS.
W71-04094 06E

LITTLE FALLS FIBRE CO V HENRY FORD AND SON, INC (FLASHBOARDS REDUCING RIPARIAN OWNER'S POWER HEAD).
W71-04203 06E

PUBLIC WORKS AUTHORIZATIONS, 1968 - RIVERS AND HARBORS - FLOOD CONTROL AND MULTIPLE PURPOSE PROJECTS - PART I.
W71-04254 06E

PESTICIDE RESIDUES
PESTICIDES IN SURFACE WATERS OF THE UNITED STATES A FIVE-YEAR SUMMARY 1964-1968,
W71-04201 05A

PHASE DIAGRAMS
MINERAL RECOVERY FROM CONCENTRATED BRINES,
W71-04223 02K

PHENOLS
MICRODETERMINATION OF DERIVATIVES OF PHENOLS AND MERCAPTANS BY MEANS OF ELECTRON CAPTURE GAS CHROMATOGRAPHY,
W71-04218 05A

PHOSPHATE
CHEMICAL PRECIPITATION OF PHOSPHATE WITHIN A HIGH RATE BIO OXIDATION SYSTEM I. SYNTHETIC SEWAGE STUDIES,
W71-03900 05D

PHOSPHATE REMOVAL
CHEMICAL EXFOLIATED VERMICULITE FOR REMOVAL OF PHOSPHATE FROM WASTE WATERS,
W71-04107 05D

PHOSPHATES
MICROBIAL CARBONATE AND PHOSPHATE PRECIPITATES FROM SEA WATER CULTURES,
W71-03950 02K

BIODEGRADABILITY OF POTENTIAL ORGANIC SUBSTITUTES FOR PHOSPHATES,
W71-04072 05D

CHEMICAL EXFOLIATED VERMICULITE FOR REMOVAL OF PHOSPHATE FROM WASTE WATERS,
W71-04107 05D

METHOD SELECTION STUDY 1 A COMPARISON OF THREE MODIFICATIONS OF THE SINGLE REAGENT METHOD FOR SOLUBLE ORTHOPHOSPHATE,
W71-04204 05A

ACCUMULATION OF PHOSPHATES IN WATER,
W71-04216 05B

PHOSPHORUS REMOVAL
CHEMICAL PRECIPITATION OF PHOSPHATE WITHIN A HIGH RATE BIO OXIDATION SYSTEM I. SYNTHETIC SEWAGE STUDIES,
W71-03900 05D

PHOTOPERIODISMS
INFLUENCE OF TEMPERATURE AND PHOTOPERIOD ON GROWTH, FOOD CONSUMPTION AND FOOD CONVERSION EFFICIENCY OF CHANNEL CATFISH,
W71-03920 05C

PHOTOPLANKTON
THE PRESERVATION OF PHYTOPLANKTON GRAB SAMPLES,
W71-04207 05A

PHOTOSYNTHESIS
A STUDY OF PHOTOSYNTHESIS IN CLEAR LAKE, IOWA,
W71-04212 05C

PHYSICAL PROPERTIES
EMPIRICAL RELATIONSHIPS BETWEEN MASS PHYSICAL PROPERTIES FOR RECENT MARINE SEDIMENTS OFF SOUTHERN CALIFORNIA,
W71-03951 02J

PHYSIOLOGICAL ECOLOGY
FORMATION OF PHYTOGENIC HILLOCKS II. ROOTING HABIT OF PLANTS FORMING PHYTOGENIC HILLOCKS,
W71-04295 02I

RESPONSES OF NATIVE AND MIGRANT DESERT RESIDENTS TO ARID HEAT,
W71-04301 02I

PHYTOGENIC HILLOCKS
FORMATION OF PHYTOGENIC HILLOCKS II. ROOTING HABIT OF PLANTS FORMING PHYTOGENIC HILLOCKS,
W71-04295 02I

PHYTOPLANKTON
EUTROPHICATION OF WATER RESOURCES OF NEW YORK STATE, OBSERVATIONS ON NUTRIENT LIMITATION ON SUMMER PHYTOPLANKTON IN CAYUGA LAKE, 1967 AND 1968,
W71-03923 02H

A NEW FRESHWATER CENTRIC DIATOM MICROSIPHONA POTAMOS GEN. ET SP. NOV.,
W71-04193 05C

PHYTOPLANKTON, SESTON, AND DISSOLVED ORGANIC CARBON IN THE LITTLE MIAMI RIVER AT CINCINNATI, OHIO,
W71-04209 05A

A STUDY OF PHOTOSYNTHESIS IN CLEAR LAKE, IOWA,
W71-04212 05C

PIERS
BAY RIDGE DOCK CO V UNITED DRY DOCKS, INC (RIGHT TO FILL TO BULKHEAD LINE INCLUDES RIGHT TO MAINTAIN FLOATING DRY DOCK).
W71-04245 06E

PIGMENTS
ENVIRONMENTAL CONTROL OF COLORATION IN AN ACRIDID, GASTRIMARGUS AFRICANUS (SAUSSURE),
W71-04302 03F

PLANATION SURFACES
SOME ASPECTS OF THE GEOMORPHOLOGY OF THE AIR MOUNTAINS, SOUTHERN SAHARA,
W71-04050 02G

PLANKTON
A GUIDE TO THE COMMON DIATOMS AT WATER POLLUTION SURVEILLANCE SYSTEM STATIONS,
W71-04210 07C

PLANNING
NATURAL RESOURCE SYSTEMS MODELS IN DECISION MAKING.
W71-03855 06A

SYSTEMS ANALYSIS FOR WATER SUPPLY AND POLLUTION CONTROL,
W71-03857 06A

WATER RESOURCES PLANNING IN THE URBAN-METROPOLITAN CONTEXT,
W71-03861 06B

INCORPORATING SOCIAL OBJECTIVES IN SYSTEMS MODELS,
W71-03862 06B

A COMPREHENSIVE WATER QUALITY CONTROL PROGRAM FOR THE LAS VEGAS WASH DRAINAGE BASIN. PHASE I.
W71-03901 05D

MATHEMATICAL PROGRAMMING APPLICATIONS TO WATER QUALITY PLANNING FOR THE BOSTON HARBOR REGION,
W71-04036 05G

ASPECTS OF PLANNING, EVALUATION, AND DECISION-MAKING IN SPORT FISHERY MANAGEMENT.
W71-04271 06B

THE IMPACT OF AGRICULTURAL CHANGE ON A LOCAL ECONOMY IN THE GREAT PLAINS,
W71-04289 03F

PLANT DISEASES
ROOTSTOCKS FOR VALENCIA ORANGES AND LIBSON LEMONS IN ARIZONA,
W71-04059 03F

PLANT GROWTH
ROOT DEVELOPMENT OF TWO COMMON SPECIES IN DIFFERENT HABITATS IN THE MEDITERRANEAN SUBREGION IN EGYPT,
W71-04300 02I

PLANT POPULATIONS
PERENNATION IN ASTRAGALUS LENTIGINOSUS AND TRIDENS PULCHELLUS IN RELATION TO RAINFALL,
W71-04299 02I

PLANT WATER POTENTIAL
MEASUREMENT OF WATER POTENTIAL WITH THERMOCOUPLE PSYCHROMETERS CONSTRUCTION AND APPLICATIONS,
W71-04237 02I

PLANT WATER RELATIONS
WATER POTENTIAL MEASUREMENTS IN TRESS,
W71-04238 02I

PLANT-WATER RELATIONS
MEASUREMENT OF WATER POTENTIAL WITH THERMOCOUPLE PSYCHROMETERS CONSTRUCTION AND APPLICATIONS,
W71-04237 02I

PLASTICS MEDIA
HIGH-RATE BIOFILTRATION PAST AND FUTURE,
W71-04076 05D

POLITICAL ASPECTS
CONDITIONS OF LEGAL AND POLITICAL FEASIBILITY,
W71-03866 06E

THE POLITICS OF WATER,
W71-04091 06E

ENVIRONMENTAL JURISDICTION IN THE CONGRESS AND THE EXECUTIVE,
W71-04106 06E

PUBLIC WORKS AUTHORIZATIONS, 1968 - RIVERS AND HARBORS - FLOOD CONTROL AND MULTIPLE PURPOSE PROJECTS - PART I.
W71-04254 06E

POLLUTANT IDENTIFICATION
ECORSE RIVER WATER QUALITY STUDY, MAY-JULY, 1969.
W71-03907 05B

POLLUTION ABATEMENT
SYSTEMS ANALYSIS FOR WATER SUPPLY AND POLLUTION CONTROL,
W71-03857 06A

PROCEEDINGS CONFERENCE ON POLLUTION OF LAKE MICHIGAN AND ITS TRIBUTARY BASIN, ILLINOIS, INDIANA, MICHIGAN, AND WISCONSIN.
W71-04256 05G

OUTLINE -- ENFORCEMENT OF 1899 REFUSE ACT THROUGH CITIZEN ACTION.
W71-04336 06E

POLYVINYL CHLORIDE
HIGH-RATE BIOFILTRATION PAST AND FUTURE,
W71-04076 05D

POLYWATER
DENTISTRY PROFESSOR EXPLAINS POLYWATER.
W71-03926 01B

PORE GEOMETRY
USE OF PORE CASTS AND SCANNING ELECTRON MICROSCOPE TO STUDY PORE GEOMETRY,
W71-03946 07B

PORES
USE OF PORE CASTS AND SCANNING ELECTRON MICROSCOPE TO STUDY PORE GEOMETRY,
W71-03946 07B

POROSITY
USE OF PORE CASTS AND SCANNING ELECTRON MICROSCOPE TO STUDY PORE GEOMETRY,
W71-03946 07B

THE DIFFUSION OF IONS IN UNCONSOLIDATED SEDIMENTS,
W71-03954 02K

FABRICATION OF FELT-MEMBRANE COMPOSITES,
W71-04222 03A

POROUS MEDIA
USE OF PORE CASTS AND SCANNING ELECTRON MICROSCOPE TO STUDY PORE GEOMETRY,
W71-03946 07B

FABRICATION OF FELT-MEMBRANE COMPOSITES,
W71-04222 03A

POST AERATION BASINS
DESIGN OF PLUGFLOW POST AERATION BASIN,
W71-03889 05D

POTENTIAL EVAPOTRANSPIRATION
AGROMETEOROLOGY SURVEY OF THE HIGHLANDS OF EASTERN AFRICA,
W71-04062 02D

POTENTIAL EVAPOTRANSPIRATION AND THE WATER BALANCE IN WEST AFRICA AN ALTERNATIVE METHOD OF PENMAN,
W71-04063 02D

A NEW APPROACH TO THE CLASSIFICATION OF CLIMATE,
W71-04235 02B

PROBLEMS OF DETERMINING EVAPOTRANSPIRATION IN THE SEMI-ARID TROPICS ILLUSTRATED WITH REFERENCE TO THE SUDAN,
W71-04236 02D

SECULAR VARIATION OF ARIDITY IN THE WORLD,
W71-04288 02A

SOME ASPECTS OF DROUGHT CLIMATOLOGY OF THE DRY SUBHUMID ZONES OF SOUTH INDIA,
W71-04298 02B

POTOMAC RIVER BASIN COMMISSION
THE PROPOSED POTOMAC RIVER BASIN COMPACT,
W71-04090 06E

POWER COSTS
DRY LANDS AND A HUNGRY WORLD,
W71-04291 06B

POWER SYSTEM OPERATIONS
AN APPROACH TO FINDING RESERVOIR RULES FOR POWER OPTIMIZATION,
W71-04037 04A

PRECAST CONCRETE
PRECAST REINFORCED CONCRETE IN HYDRAULIC CONSTRUCTION,
W71-04015 08F

PRECIPITATION GAGES
VERIFYING RECORDING PRECIPITATION GAUGE RECORDS,
W71-04264 07C

PRECIPITATION INTENSITY
VERIFYING RECORDING PRECIPITATION GAUGE RECORDS,
W71-04264 07C

PRECIPITATION(ATMOSPHERIC)
OPTIMIZATION FOR PLANNING AND LOCATION OF PRECIPITATION STATIONS IN THE JEMEZ MOUNTAINS,
W71-04033 06A

QUANTITATIVE REGIONAL PREDICTION OF RAINFALL IN ECAFE REGIONS,
W71-04152 02B

VERTICAL VELOCITY AND RAINFALL COMPUTATION,
W71-04153 02B

DETECTION OF PRECIPITATION BY RADAR,
W71-04154 07B

SOME EXAMPLES OF HEAVY RAINFALL IN JAPAN,
W71-04166 02B

THE PROBLEM OF FLOOD PREDICTION ON THE EAST COAST OF WEST MALAYSIA,
W71-04167 02B

HEAVY RAINFALL IN PAKISTAN AND ITS ASSOCIATED FLOOD,
W71-04168 02B

HEAVY RAINFALL AND ASSOCIATED FLOODS IN WEST PAKISTAN,
W71-04169 02B

THE CIRCULATION PATTERN OVER SINGAPORE AND THE EAST COAST OF WEST MALAYSIA DURING JANUARY AND FEBRUARY 1967 COMPARED WITH THAT OF JANUARY AND FEBRUARY 1968,
W71-04170 02B

THE CLIMATE OF INTERIOR OMAN,
W71-04227 02B

VERIFYING RECORDING PRECIPITATION GAUGE RECORDS,
W71-04264 07C

SECULAR VARIATION OF ARIDITY IN THE WORLD,
W71-04288 02A

PREDATOR-PREY RELATIONSHIP
PREDATOR-PREY RELATIONSHIPS IN A MODEL FOR THE ACTIVATED PROCESS,
W71-04070 05D

PREFERENCES(WATER RIGHTS)
PRINCIPLES OF WATER RIGHTS LAW IN OHIO,
W71-04022 06E

PRESCRIPTIVE RIGHTS
IN RE ROMA (ABILITY OF UPLAND OWNER TO ACQUIRE TITLE TO SUBMERGED LANDS BY ADVERSE POSSESSION).
W71-04146 06E

HANSON V BERT WAY ESTATE (RIPARIAN RIGHTS OF ADVERSE POSSESSOR).
W71-04315 06E

PRE-TREATMENT(WATER)
PRETREATMENT OF TOXIC WASTES,
W71-04082 05D

PRIVATE COSTS
PRIVATE AND SOCIAL COSTING AND PRICING AS DECISION DETERMINANTS,
W71-03863 06C

PROBABILITY
CHARACTERISTICS OF THE CONSTRUCTION OF EQUALLY PROBABLE FLASH FLOOD HYDROGRAPHS,
W71-03976 02E

DETERMINATION OF MAXIMUM FLOOD FLOW AND THE PROBABILITY OF ITS BEING EXCEEDED, USING INCOMPLETE INFORMATION (FRENCH),
W71-03979 02E

THE CALCULATION OF RAINFALL FROM A HURRICANE,
W71-03993 02B

PROBABILITY HYDROGRAPHS
CHARACTERISTICS OF THE CONSTRUCTION OF EQUALLY PROBABLE FLASH FLOOD HYDROGRAPHS,
W71-03976 02E

PROBABLE MAXIMUM PRECIPITATION
THE CALCULATION OF RAINFALL FROM A HURRICANE,
W71-03993 02B

LECTURE 2 - PROBABLE MAXIMUM PRECIPITATION (PMP) ESTIMATION,
W71-04161 02B

LECTURE 3 - STORM MAXIMIZATION TECHNIQUES IN EQUATORIAL/TROPICAL REGIONS,
W71-04162 02B

LECTURE 4 - ESTIMATION OF PMP AND MAXIMUM FLOODS BY STATISTICAL METHODS,
W71-04163 02B

PRODUCTION COSTS
ASPECTS OF THE SOUTH AUSTRALIAN CITRUS INDUSTRY,
W71-04051 03F

PROFILES
FLOOD PROFILE STUDY, HOOSIER CREEK, LINN COUNTY, IOWA,
W71-03932 02E

PROGRAMS
PROCEEDINGS CONFERENCE ON POLLUTION OF LAKE MICHIGAN AND ITS TRIBUTARY BASIN, ILLINOIS, INDIANA, MICHIGAN, AND WISCONSIN.
W71-04256 05G

PROJECT PLANNING
A PROPOSED STREAMFLOW DATA PROGRAM FOR NEW YORK,
W71-03933 07A

OPTIMIZATION FOR PLANNING AND LOCATION OF PRECIPITATION STATIONS IN THE JEMEZ MOUNTAINS,
W71-04033 06A

PROJECTS
HEARINGS BEFORE THE SUBCOMMITTEE ON FLOOD CONTROL - RIVERS AND HARBORS THE COMMITTEE ON PUBLIC WORKS, UNITED STATES SENATE, 90TH CONGRESS, 2ND SESSION.
W71-04255 06E

PROTOZOA
PREDATOR-PREY RELATIONSHIPS IN A MODEL FOR THE ACTIVATED PROCESS,
W71-04070 05D

PROVENANCE
MINERAL AND CHEMICAL COMPOSITION OF SEDIMENTS FROM THE STRAITS OF FLORIDA,

W71-03944 02J

A GEOCHEMICAL TREND IN SILICON-ALUMINUM-IRON RATIOS AND THE CLASSIFICATION OF CLASTIC SEDIMENTS,
W71-03945 02K

PSYCHROMETERS
POTENTIAL EVAPOTRANSPIRATION AND THE WATER BALANCE IN WEST AFRICA AN ALTERNATIVE METHOD OF PENMAN,
W71-04063 02D

PUBLIC HEALTH
CITY OF SALEM V HARDING (CITY'S NEGLIGENCE IN CAUSING ILLNESS BY CONTAMINATION OF WATER SUPPLY).
W71-04278 06E

WIESNER V CITY OF ALBANY (MUNICIPAL LIABILITY FOR TYPHOID EPIDEMIC CAUSED BY DEFECTIVE PIPELINE).
W71-04322 06E

PUBLIC RIGHTS
LAW OF SEASHORE, WATERS AND WATERCOURSES OF MAINE AND MASSACHUSETTS,
W71-04257 04A

PEOPLE V PORT OF NEW YORK AUTHORITY (REMEDY FOR POLLUTION OF STATE PROPERTY).
W71-04311 06E

OYSTERMEN'S DOCK COMPANY V DOWNING (LAND UNDER TIDAL WATERS HELD IN PUBLIC TRUST).
W71-04329 06E

PUBLIC UTILITIES
STRUCTURE OF PUBLICLY-OWNED WATER UTILITIES,
W71-04281 06E

ECONOMIC CONSIDERATIONS IN FACILITY PLANNING,
W71-04285 06B

PUBLICATIONS
GLOSSARY OF TERMS USED IN WELL LOGGING,
W71-04113 10

PULP WASTES
ENGINEERING FEASIBILITY DEMONSTRATION STUDY FOR MUSKEGON COUNTY, MICHIGAN, WASTE WATER TREATMENT-IRRIGATION SYSTEM.
W71-04186 05D

PUMPING
SUPERFARMS VS. SAGEBRUSH NEW IRRIGATION DEVELOPMENTS ON THE SNAKE RIVER PLAIN,
W71-04056 03F

THE PUMPED WELL,
W71-04292 04B

PUMPING TESTS
GEOHYDROLOGIC BOUNDARY ENVELOPES,
W71-04125 02F

QUASILINEARIZATION
STREAM QUALITY MODELING BY QUASILINEARIZATION,
W71-04045 05F

QUESTA MINE(N MEX)
WASTE PROBLEMS RELATIVE TO MINING AND MILLING OF MOLYBDENUM,
W71-03888 05D

RADAR
RECONSTRUCTION OF SUBGLACIAL RELIEF FROM RADIO ECHO SOUNDING RECORDS,
W71-04112 02C

DETECTION OF PRECIPITATION BY RADAR,
W71-04154 07B

ANALYSIS OF MESOSCALE SYSTEMS,
W71-04157 02B

RADIATION
PREDICTION OF SOLAR AND ATMOSPHERIC RADIATION FOR ENERGY BUDGET STUDIES OF LAKES AND STREAMS,
W71-04020 02B

RADIO ECHO SOUNDING
RECONSTRUCTION OF SUBGLACIAL RELIEF FROM RADIO ECHO SOUNDING RECORDS,
W71-04112 02C

RADIOACTIVE DATING
ISOTOPE HYDROLOGY, 1970.
W71-04133 02A

RADIOACTIVITY TECHNIQUES
ISOTOPE HYDROLOGY, 1970.
W71-04133 02A

RADIOISOTOPES
ISOTOPE HYDROLOGY, 1970.
W71-04133 02A

RADIOSTRONTIUM
MOVEMENT OF ALGAL- AND FUNGAL-BOUND RADIOSTRONTUM AS CHELATE COMPLEXES IN A CALCAREOUS SOIL,
W71-04067 05B

RADIOSTRONTIUM COMPLEXES
MOVEMENT OF ALGAL- AND FUNGAL-BOUND RADIOSTRONTUM AS CHELATE COMPLEXES IN A CALCAREOUS SOIL,
W71-04067 05B

RAILROADS
PENNSYLVANIA RR V LINCOLN TRUST CO (RAILROAD AND MUNICIPAL NEGLIGENCE IN MAINTAINING WATER PURITY).
W71-04252 06E

PEOPLE EX REL WESTERN NEW YORK AND P RY V STATE TAX COMM'N (ASSESSMENT OF RAILROAD BRIDGE AS A SPECIAL FRANCHISE).
W71-04342 06E

RAIN
CLOUD SEEDING POTENTIALITIES IN LOS ANGELES COUNTY.
W71-03903 03B

RAIN GAGE NETWORKS
A CONTRIBUTION TO THE PROBLEM OF SPACING RAINGAUGES IN RUGGED TERRAIN,
W71-04122 07A

RAIN GAGES
A CONTRIBUTION TO THE PROBLEM OF SPACING RAINGAUGES IN RUGGED TERRAIN,
W71-04122 07A

A RAPID METHOD OF COMPUTING AREAL RAINFALL,
W71-04123 07B

ANALYSIS OF RAINFALL OVER A SMALL AREA,
W71-04155 02B

VERIFYING RECORDING PRECIPITATION GAUGE RECORDS,
W71-04264 07C

RAINFALL
THE CALCULATION OF RAINFALL FROM A HURRICANE,
W71-03993 02B

AGROMETEOROLOGY SURVEY OF THE HIGHLANDS OF EASTERN AFRICA,
W71-04062 02D

A RAPID METHOD OF COMPUTING AREAL RAINFALL,
W71-04123 07B

LECTURE 1 - FACTORS INFLUENCING RAINFALL FORMATION AND DISTRIBUTION,
W71-04160 02B

PROBLEMS OF DETERMINING EVAPOTRANSPIRATION IN THE SEMI-ARID TROPICS ILLUSTRATED WITH REFERENCE TO THE SUDAN,
W71-04236 02D

PERENNATION IN ASTRAGALUS LENTIGINOSUS AND TRIDENS PULCHELLUS IN RELATION TO RAINFALL,
W71-04299 02I

RAINFALL DISPOSITION
ANALYSIS OF RAINFALL OVER A SMALL AREA,
W71-04155 02B

RAINFALL DISTRIBUTION
A RAPID METHOD OF COMPUTING AREAL RAINFALL,
W71-04123 07B

RAINFALL INTENSITY
VERIFYING RECORDING PRECIPITATION GAUGE RECORDS,
W71-04264 07C

RAINFALL-RUNOFF RELATIONSHIPS
THE INFLUENCE OF LANDFORM AND PRECIPITATION PARAMETERS ON FLOOD HYDROGRAPHS,
W71-03871 02E

THE RELATIONSHIP BETWEEN SUMMER LOW FLOWS AND GEOLOGY IN NORTHLAND, NEW ZEALAND,
W71-03931 02A

DETERMINATION OF THE DISTRIBUTION OF RAINFALL FLOODS IN LARGE CATCHMENTS USING HYDROMETEOROLOGICAL DATA,
W71-03977 02E

EVALUATION OF MAXIMUM RAINFALL DISCHARGE FROM A REGION OF DEFICIENT RAINFALL DATA,
W71-03978 02E

DETERMINATION OF MAXIMUM FLOOD FLOW AND THE PROBABILITY OF ITS BEING EXCEEDED, USING INCOMPLETE INFORMATION (FRENCH),
W71-03979 02E

ANALYSIS OF THE RELATION BETWEEN PRECIPITATION AND FLOOD FLOW WITH THE AID OF A TRIPLE TRANSFORMATION BASED ON THE UNIT HYDROGRAPH METHOD (FRENCH),
W71-03980 02A

CONSTRUCTION OF THE UNIT HYDROGRAPH BY THE METHOD OF HYDROLOGIC ANALOGY (FRENCH),
W71-03981 02E

COMPUTATION OF MAXIMUM STORM DISCHARGE OF MOUNTAIN RIVERS,
W71-03982 02A

EVALUATION OF MAXIMUM FLOW OF FLOODS USING PRECIPITATION DATA (FRENCH),
W71-03983 02A

PROBABLE FLOOD DISCHARGES OF THE PO RIVER TRIBUTARIES,
W71-03987 02E

FORMATION OF RAINFALL FLOODS ON SMALL WATERSHEDS. PRINCIPLES OF MAXIMUM STORM RUNOFF COMPUTATION,
W71-03988 02A

PRACTICAL METHODS OF ESTIMATING MAXIMUM FLOODS (FRENCH),
W71-03990 02E

CALCULATION OF THE MAXIMUM RUNOFF IN FLOODS FROM RAINFALL OVER THE TERRITORIES OF THE UKRAINE AND MOLDAVIA (WITH NO OR INSUFFICIENT HYDROMETRICAL DATA),
W71-03991 02A

METHOD OF ESTIMATING STORM RUNOFF FROM SMALL DRAINAGE BASINS,
W71-03992 02E

PREDICTION OF FLOODS FROM HEAVY RAINFALL,
W71-04159 02E

SEVERE CYCLONIC STORM RESPONSIBLE FOR FLASH FLOOD IN PAKOKKU AND MONYWA DISTRICTS DURING THE MONTH OF OCTOBER 1967,
W71-04164 02B

LOWER AND MIDDLE IRRAWADDY FLOODS IN RELATION TO HEAVY RAINFALL IN THE HEAD WATER REGIONS OF CHINDWIN AND IRRAWADDY RIVERS,
W71-04165 02E

A SIMPLE CASCADE WATERSHED MODEL,
W71-04181 02A

RANGE MANAGEMENT
THE SAM SIMON WATERSHED SHRUB CONTROL,
W71-04058 03F

RANGES
FOURWING SALTBUSH CAN BE FIELD PLANTED SUCCESSFULLY,
W71-04247 04A

REAERATION
DESIGN OF PLUGFLOW POST AERATION BASIN,
W71-03889 05D

REARING DEVICE
REARING DEVICES FOR STREAM INSECT LARVAE,
W71-04190 07B

RECHARGE
WATER MOVEMENT IN THE UNSATURATED ZONE OF HIGH AND LOW PERMEABILITY STRATA BY MEASURING NATURAL TRITIUM,
W71-04138 02A

RECLAMATION STATES
RECLAMATION IN THE UNITED STATES,
W71-04306 06C

RECOVERY
WASTE CONTROL HIGHLIGHTS PLANT DESIGN.
W71-03899 05D

PRETREATMENT OF TOXIC WASTES,
W71-04082 05D

RECREATION DEMAND
THE LAND AND WATER CONSERVATION FUND ACT DEVELOPMENT AND IMPACT,
W71-04097 06E

RECREATION FACILITIES
ECONOMIC ANALYSIS OF MARINAS IN MARYLAND,
W71-04267 06D

RED LOCUST
THE DEVELOPMENT OF EGGS OF THE RED LOCUST NOMADACRIS SEPTEMFASCIATA (SERV.), AND THE AFRICAN MIGRATORY LOCUST, LOCUSTA MIGRATORIA MIGRATORIOIDES (R. AND F.), AND ITS INTERRUPTION UNDER PARTICULAR CONDITIONS OF HUMIDITY,
W71-04297 03F

REFUSE ACT
FEDERAL ENFORCEMENT UNDER THE REFUSE ACT OF 1899,
W71-04102 06E

REFUSE ACT OF 1899
OUTLINE -- ENFORCEMENT OF 1899 REFUSE ACT THROUGH CITIZEN ACTION.
W71-04336 06E

REGIMEN
PROBLEM OF THE CLASSIFICATION AND SPATIAL VARIABILITY OF THE ALBEDO OF A HOMOGENEOUS GLACIER SURFACE DURING THE ABLATION PERIOD,
W71-03971 02C

COMPUTATION OF FLOW IN GLACIER-FED RIVERS,
W71-03975 02E

EXCHANGE OF DEUTERIUM BETWEEN ICE AND WATER IN GLACIOLOGICAL STUDIES IN ICELAND,
W71-04137 02A

REGIONAL ANALYSIS
APPLICATION OF INDUSTRIAL DYNAMICS CONCEPTS TO DECISION MAKING IN ENVIRONMENTAL MANAGEMENT,
W71-04025 05G

AGROMETEOROLOGY SURVEY OF THE HIGHLANDS OF EASTERN AFRICA,
W71-04062 02D

POTENTIAL EVAPOTRANSPIRATION AND THE WATER BALANCE IN WEST AFRICA AN ALTERNATIVE METHOD OF PENMAN,
W71-04063 02D

THE LOCATION OF LAND USE TYPES THE NILE VALLEY IN NORTHERN SUDAN,
W71-04228 04A

SPATIAL PATTERNS OF SOCIO-ECONOMIC STRUCTURE IN INDIA,
W71-04234 06B

RELIABILITY
FWPCA METHOD STUDY 1 MINERAL AND PHYSICAL ANALYSES - AN EVALUATION OF FWPCA ANALYTICAL METHODS FOR SURFACE WATERS,
W71-04200 05A

RELICT STRUCTURES
SOME PROBLEMS OF A KARST AREA IN THE EASTERN TRANSVAAL, SOUTH AFRICA,
W71-04053 02G

RELOCATION
OPTIMIZATION FOR PLANNING AND LOCATION OF PRECIPITATION STATIONS IN THE JEMEZ MOUNTAINS,
W71-04033 06A

REMEDIES
FEDERAL ENFORCEMENT UNDER THE REFUSE ACT OF 1899,
W71-04102 06E

OUTLINE -- ENFORCEMENT OF 1899 REFUSE ACT THROUGH CITIZEN ACTION.
W71-04336 06E

REMOTE SENSING
ESTIMATION OF SEA SURFACE TEMPERATURE FROM SPACE,
W71-03959 07B

RECONSTRUCTION OF SUBGLACIAL RELIEF FROM RADIO ECHO SOUNDING RECORDS,
W71-04112 02C

DETECTION OF PRECIPITATION BY RADAR,
W71-04154 07B

RESEARCH AND DEVELOPMENT
FEDERAL WATER RESOURCES RESEARCH ACTIVITIES.
W71-04105 06E

RESEARCH FACILITIES
THE HYDROLOGY OF SAGEBRUSH LANDS AND THE MANAGEMENT OF BLOWING SNOW,
W71-04248 03B

SUMMARY OF SNOW RESEARCH BY THE ROCKY MOUNTAIN FOREST AND RANGE EXPERIMENT STATION AT LARAMIE, WYOMING.,
W71-04249 02C

RESERVOIR DESIGN
COMMENTS ON 'THE LINEAR DECISION RULE IN RESERVOIR MANAGEMENT AND DECISION RULE IN RESERVOIR MANAGEMENT AND DESIGN' BY CHARLES REVELLE, ERHARD JOERES AND WILLIAM KIRBY,
W71-04029 06B

RESERVOIR OPERATION
PLANNING FOR THE OSWEGO BASIN IN NEW YORK--A SYSTEMS APPROACH,
W71-03860 06A

PROCEEDINGS OF A SEMINAR ON RESERVOIR SYSTEMS ANALYSIS, 4-6 NOVEMBER 1969.
W71-04034 04A

OPTIMUM FIRE POWER OUTPUT FROM A TWO RESERVOIR SYSTEM BY INCREMENTAL DYNAMIC PROGRAMMING,
W71-04111 04A

RESERVOIR OPERATIONS
AN APPROACH TO FINDING RESERVOIR RULES FOR POWER OPTIMIZATION,
W71-04037 04A

RESERVOIR SITES
1969 RESERVOIR LAND USE SURVEYS FIELD REPORT AND PROCEDURAL MANUAL,
W71-04039 04A

RESERVOIRS
WATER-QUALITY DATA FOR THE FLAMING GORGE RESERVOIR AREA, UTAH AND WYOMING,
W71-03936 07C

RESOURCE MANAGEMENT
INTERACTION AMONG NATURAL RESOURCE SYSTEMS, THE DECISION MAKERS AND THE PUBLIC IN THE 2000'S,
W71-03868 06B

RESOURCE REQUIREMENTS
ALTERNATIVE CROP ENTERPRISE BUDGETS FOR IRRIGATED PRODUCTION, SOUTHWESTERN OKLAHOMA,
W71-04294 03F

RESOURCE SYSTEMS
RESOURCE SYSTEMS MODELS IN DECISION MAKING,
W71-03856 06A

RESPIRATION
RESPIRATORY RELATIONSHIPS OF A SYMBIOTIC ALGAL-BACTERIAL CULTURE FOR WASTE WATER NUTRIENT REMOVAL,
W71-04079 05D

RETURN FLOW
DEVELOPMENT OF ECONOMICAL METHODS OF BORON REMOVAL FROM IRRIGATION RETURN WATERS,
W71-03914 05D

REVERSE OSMOSIS

POROUS TUBULET SUPPORTS FOR DESALINATION BARRIERS,
W71-03911 03A

WATER TRANSPORT THROUGH PLASTICIZED MEMBRANES,
W71-03912 03A

DEVELOPMENT OF ECONOMICAL METHODS OF BORON REMOVAL FROM IRRIGATION RETURN WATERS,
W71-03914 05D

MEMBRANE MATERIALS FOR WASTE WATER RECLAMATION BY REVERSE OSMOSIS,
W71-04185 05D

FABRICATION OF FELT-MEMBRANE COMPOSITES,
W71-04222 03A

REVERSE OSMOSIS DESALTING STATE-OF-THE-ART (1969).
W71-04225 03A

REVIES
REVERSE OSMOSIS DESALTING STATE-OF-THE-ART (1969).
W71-04225 03A

REVIEWS
A REVIEW OF CURRENT RESEARCH ON COAL MINE DRAINAGE IN APPALACHIA,
W71-03874 05B

FACTORS THAT AFFECT THE FORMATION OF COAL MINE DRAINAGE POLLUTION IN APPALACHIA,
W71-03875 05B

THE OXIDATION OF PYRITE ASSOCIATED WITH COAL MINES,
W71-03876 05B

SEDIMENT TRANSPORT IN DEGRADING RIVERS,
W71-03995 02J

EFFECTS OF WASTE DISPOSAL INTO MARINE WATERS - A SURVEY OF STUDIES CARRIED OUT IN THE LAST TEN YEARS,
W71-04114 05C

THE WORLD OF WATER,
W71-04118 02A

RE-CIRCULATED WATER
WASTE WATER RESULTING FROM THE CONCENTRATION OF LOW GRADE IRON ORE,
W71-04083 05D

RE-CYCLE
WASTE CONTROL HIGHLIGHTS PLANT DESIGN.
W71-03899 05D

RHEOLOGY
SOME FEATURES OF THE MECHANICS OF GLACIER MOVEMENT,
W71-03972 02C

RIPARIAN LAND
RIPARIAN AND LITTORAL RIGHTS A SURVEY OF SOME OF THE LEGAL PROBLEMS INVOLVED IN RESIDENTIAL AND COMMERCIAL USES ALONG THE WATER'S EDGE IN RELATION TO THE SUBSTANTIVE ASPECTS OF PUBLIC POLICY,
W71-04095 06E

JACOBS V ELWELL (RIGHT TO PREVENT CONSTRUCTION ON BEACH).
W71-04318 06E

RIPARIAN RIGHTS
RIPARIAN AND LITTORAL RIGHTS A SURVEY OF SOME OF THE LEGAL PROBLEMS INVOLVED IN RESIDENTIAL AND COMMERCIAL USES ALONG THE WATER'S EDGE IN RELATION TO THE SUBSTANTIVE ASPECTS OF PUBLIC POLICY,
W71-04095 06E

COMPETITION FOR WATER IN AN EXPANDING ECONOMY POLICIES AND INSTITUTIONS,
W71-04268 06E

HANSON V BERT WAY ESTATE (RIPARIAN RIGHTS OF ADVERSE POSSESSOR).
W71-04315 06E

JACOBS V ELWELL (RIGHT TO PREVENT CONSTRUCTION ON BEACH).
W71-04318 06E

IN RE WATERFRONT OF CITY OF NEW YORK (RIPARIAN RIGHTS SUBJECT TO PUBLIC RIGHT TO IMPROVE NAVIGATION).
W71-04323 06E

WATER-USE LAW IN MISSOURI,
W71-04339 06E

RISK
PRIVATE AND SOCIAL COSTING AS DECISION DETERMINANTS IN WATER RESOURCES,
W71-03864 06B

RIVER BASIN COMMISSIONS
THE PROPOSED POTOMAC RIVER BASIN COMPACT,
W71-04090 06E

RIVER BASIN DEVELOPMENT
THE DELAWARE RIVER BASIN COMPACT--AN ALTERNATIVE FOR IMPLEMENTING WATER RESOURCES MANAGEMENT (ORGANIZATION, OPERATION, AND RESULTS OF THE BASIN COMPACT),
W71-04089 06E

THE PROPOSED POTOMAC RIVER BASIN COMPACT,
W71-04090 06E

PLAN FOR DEVELOPMENT OF THE LAND AND WATER RESOURCES OF THE SOUTHEAST UNITED STATES RIVER BASINS.
W71-04266 06E

RIVER BASINS
THE LOCATION OF LAND USE TYPES THE NILE VALLEY IN NORTHERN SUDAN,
W71-04228 04A

RIVER THERMAL REGIME
SOME CHARACTERISTICS OF THE THERMAL REGIME OF RIVERS IN THE DANUBE AND DNIESTER BASINS,
W71-03974 02K

RIVERS AND HARBORS ACT
FEDERAL ENFORCEMENT UNDER THE REFUSE ACT OF 1899,
W71-04102 06E

OUTLINE -- ENFORCEMENT OF 1899 REFUSE ACT THROUGH CITIZEN ACTION.
W71-04336 06E

ROAD CONSTRUCTION
BOOBER V TOWNE (ROAD DEPARTMENT'S LIABILITY FOR INCREASING THE FLOW OF WATER OVER CONTIGUOUS LAND).
W71-04333 06E

ROADS
RAGAN V SUSQUEHANNA POWER CO (DAMAGES FOR FAILURE TO RELOCATE ROAD FLOODED BY DAM BACKWATER).
W71-04340 06E

ROOT DEVELOPMENT
FORMATION OF PHYTOGENIC HILLOCKS II. ROOTING HABIT OF PLANTS FORMING PHYTOGENIC HILLOCKS,
W71-04295 02I

ROOT DEVELOPMENT OF TWO COMMON SPECIES IN DIFFERENT HABITATS IN THE MEDITERRANEAN SUBREGION IN EGYPT,
W71-04300 02I

ROOTSTOCKS
ROOTSTOCKS FOR VALENCIA ORANGES AND LIBSON LEMONS IN ARIZONA,
W71-04059 03F

ROTATING COMPONENTS
DETERMINING THE CRITICAL SPEEDS OF HYDRAULIC UNIT SHAFTS,
W71-03996 08C

ROTIFERS
PREDATOR-PREY RELATIONSHIPS IN A MODEL FOR THE ACTIVATED PROCESS,
W71-04070 05D

ROUTING
CALCULATION OF THE MAXIMUM RUNOFF IN FLOODS FROM RAINFALL OVER THE TERRITORIES OF THE UKRAINE AND MOLDAVIA (WITH NO OR INSUFFICIENT HYDROMETRICAL DATA),
W71-03991 02A

CALCULATION OF FLOOD WAVES FOR A LARGE RIVER SYSTEM,
W71-04176 02E

A METHOD FOR THE CALCULATION OF SPRING FLOODS,
W71-04178 02E

RUNOFF
QUALITY OF RUNOFF FROM DIVERSIFIED URBAN WATERSHEDS,
W71-03929 05A

MAP OF TOTAL STREAMFLOW FROM THE TERRITORY OF THE SOVIET UNION,
W71-03960 02E

HYDROGRAPH SYNTHESIS FOR WATERSHED SUBZONES FROM MEASURED URBAN PARAMETERS,
W71-04184 04C

RUNOFF FORECASTING
WATER SUPPLY OUTLOOK FOR THE WESTERN UNITED STATES, 1970-71 WATER YEAR.
W71-03927 02B

DERIVATION OF A GENERAL FLOOD WAVE HYDROGRAPH FROM A CONTINUOUS WATERSHED WATER BALANCE,
W71-03989 02E

CALCULATION OF THE MAXIMUM RUNOFF IN FLOODS FROM RAINFALL OVER THE TERRITORIES OF THE UKRAINE AND MOLDAVIA (WITH NO OR INSUFFICIENT HYDROMETRICAL DATA),
W71-03991 02A

SOME PROBLEMS OF DETERMINING THE WATER EQUIVALENT OF THE SNOW COVER,
W71-04173 02C

METHODS OF SNOWMELT MAXIMUM DISCHARGE COMPUTATION IN CASES OF ABSENCE OR INSUFFICIENCY OF HYDROMETRIC DATA,
W71-04177 02C

RUNOFF FORECASTING(WESTERN UNITED STATES)
WATER SUPPLY OUTLOOK FOR THE WESTERN UNITED STATES, 1970-71 WATER YEAR.
W71-03927 02B

SACRAMENTO-SAN JOAQUIN DELTA
THE ECONOMIC IMPACT OF ALTERNATIVE WATER CONDITIONS, A REPORT TO THE CONTRA COSTA COUNTY WATER AGENCY.
W71-03910 06B

SAGEBRUSH
THE HYDROLOGY OF SAGEBRUSH LANDS AND THE MANAGEMENT OF BLOWING SNOW,
W71-04248 03B

SAHARA DESERT
SOME ASPECTS OF THE GEOMORPHOLOGY OF THE AIR MOUNTAINS, SOUTHERN SAHARA,
W71-04050 02G

SALINE SOILS
IMPROVING EFFICIENCY IN AGRICULTURAL WATER USE,
W71-04049 03C

SALINE WATER
FWPCA METHODS FOR CHEMICAL ANALSIS OF WATER AND WASTES.
W71-04202 05A

SALINE WATER SYSTEMS
EFFECT OF DISPERSION, GRAVITATIONAL SEGREGATION, AND FORMATION STRATIFICATION ON THE RECOVERY OF FRESHWATER STORED IN SALINE AQUIFERS,
W71-03870 02F

SALINE WATER-FRESHWATER INTERFACES
AN ECONOMIC EVALUATION OF THE WATER QUALITY ASPECTS OF CONTRA COSTA COUNTY'S OFFSHORE WATER SUPPLY.
W71-03909 06B

THE ECONOMIC IMPACT OF ALTERNATIVE WATER CONDITIONS, A REPORT TO THE CONTRA COSTA COUNTY WATER AGENCY.
W71-03910 06B

SALINITY
IMPROVING EFFICIENCY IN AGRICULTURAL WATER USE,
W71-04049 03C

IRRIGATION DEVELOPMENT IN TUNISIA,
W71-04232 03F

SALT RIVER PROJECT
WATER TABLE DECLINE AND RESULTANT AGRICULTURAL PATTERNS IN THE SALT RIVER VALLEY OF ARIZONA,
W71-04065 03F

SALT RIVER PROJECT(ARIZONA)
WATER AND CULTURE NEW DECISION RULES FOR OLD INSTITUTIONS,
W71-04296 06E

SALT RIVER VALLEY(ARIZONA)
WATER TABLE DECLINE AND RESULTANT AGRICULTURAL PATTERNS IN THE SALT RIVER VALLEY OF ARIZONA,
W71-04065 03F

SAMPLE PRESERVATION
THE PRESERVATION OF PHYTOPLANKTON GRAB SAMPLES,
W71-04207 05A

SAMPLING
ROD-MOUNTED BOTTOM GRAB,
W71-03967 07B

ON THE ACCURACY OF BED-MATERIAL SAMPLING,
W71-04132 02J

USE OF A FLOATING PERIPHYTON SAMPLER FOR WATER POLLUTION SURVEILLANCE,
W71-04194 05B

METHODS OF COLLECTION AND ANALYSIS OF PLANKTON AND PERIPHYTON SAMPLES IN THE WATER POLLUTION SURVEILLANCE SYSTEM,
W71-04195 05A

LABORATORY GUIDE FOR THE IDENTIFICATION ON PETROLEUM PRODUCTS,
W71-04199 05A

USING MACROINVERTEBRATE COLLECTIONS FOR WATER QUALITY MONITORING IN THE OHIO RIVER BASIN 1963-1966,
W71-04208 05C

A LIMESTONE-FILLED, ARTIFICIAL SUBSTRATE SAMPLER-FLOAT UNIT FOR COLLECTING MACROINVERTEBRATES IN LARGE STREAMS,
W71-04219 07B

SAND BARS
DEPOSITIONAL AND DISPERSAL DYNAMICS OF INTERTIDAL SAND BARS,
W71-03948 02J

SAND WAVES
SAND WAVES AND TIDAL CHANNELS IN THE ENTRANCE TO CHESAPEAKE BAY,
W71-03958 02L

SANDS
A MECHANICAL DEVICE FOR RELEASING FLUORESCENT TRACERS,
W71-03949 07B

TIDAL SAND MOVEMENT BETWEEN SOME LINEAR SAND BANKS IN THE NORTH SEA OFF NORTHEAST NORFOLK,
W71-03953 02J

SANTEE COUNTY WATER DISTRICT(CALIF)
SANTEE PROJECT CONTINUES TO SHOW THE WAY,
W71-03904 05D

SATURATED FLOW
SATURATION-UNSATURATION TRANSITION IN INFILTRATION TO A NON-UNIFORM SOIL PROFILE,
W71-04066 02G

SCIENTIFIC PERSONNEL
FEDERAL WATER RESOURCES RESEARCH ACTIVITIES.
W71-04105 06E

SCOUR
HYDRAULIC CRITERIA OF STREAMS WITH A MOBILE BOTTOM,
W71-03965 02J

SEA WATER
MICROBIAL CARBONATE AND PHOSPHATE PRECIPITATES FROM SEA WATER CULTURES,
W71-03950 02K

SUBMARINE VOLCANISM AS A SOURCE FOR IRON,
W71-03955 02K

SURFACE CHEMISTRY STUDIES ON THE BAY OF PANAMA,
W71-04001 02L

EFFECTS OF WASTE DISPOSAL INTO MARINE WATERS - A SURVEY OF STUDIES CARRIED OUT IN THE LAST TEN YEARS,
W71-04114 05C

SEASHORES
VARIATION IN THE LEVEL OF THE CLIFF/SHORE PLATFORM JUNCTION ALONG THE SOUTH COAST OF GREAT BRITAIN,
W71-03952 02J

SEDIMENT CONTROL
AN OVERVIEW OF U.S. DEPARTMENT OF INTERIOR'S ROLE IN SEDIMENT CONTROL,
W71-04147 04D

SEDIMENT PHYSICAL PROPERTIES
EMPIRICAL RELATIONSHIPS BETWEEN MASS PHYSICAL PROPERTIES FOR RECENT MARINE SEDIMENTS OFF SOUTHERN CALIFORNIA,
W71-03951 02J

SEDIMENT TRANSPORT
THE PERIODIC CYCLE OF PARTICULATE MATTER IN A SHALLOW, TEMPERATE ESTUARY,
W71-03943 02L

MINERAL AND CHEMICAL COMPOSITION OF SEDIMENTS FROM THE STRAITS OF FLORIDA,
W71-03944 02J

DEPOSITIONAL AND DISPERSAL DYNAMICS OF INTERTIDAL SAND BARS,
W71-03948 02J

A MECHANICAL DEVICE FOR RELEASING FLUORESCENT TRACERS,
W71-03949 07B

TIDAL SAND MOVEMENT BETWEEN SOME LINEAR SAND BANKS IN THE NORTH SEA OFF NORTHEAST NORFOLK,
W71-03953 02J

HYDRAULIC CRITERIA OF STREAMS WITH A MOBILE BOTTOM,
W71-03965 02J

SEDIMENT TRANSPORT IN DEGRADING RIVERS,
W71-03995 02J

SEDIMENTARY STRUCTURES
DEPOSITIONAL AND DISPERSAL DYNAMICS OF INTERTIDAL SAND BARS,
W71-03948 02J

SAND WAVES AND TIDAL CHANNELS IN THE ENTRANCE TO CHESAPEAKE BAY,
W71-03958 02L

SOME PROBLEMS OF A KARST AREA IN THE EASTERN TRANSVAAL, SOUTH AFRICA,
W71-04053 02G

SEDIMENTATION
MINE WASTE WATER PROBLEMS IN EUROPE,
W71-03898 05D

RADIOMETRIC INVESTIGATIONS ON THE BEACH AT THE MOUTH OF THE KURA RIVER,
W71-03962 02J

AN OVERVIEW OF U.S. DEPARTMENT OF INTERIOR'S ROLE IN SEDIMENT CONTROL,
W71-04147 04D

SEDIMENTS
A GEOCHEMICAL TREND IN SILICON-ALUMINUM-IRON RATIOS AND THE CLASSIFICATION OF CLASTIC SEDIMENTS,
W71-03945 02K

THE DIFFUSION OF IONS IN UNCONSOLIDATED SEDIMENTS,
W71-03954 02K

TECHNOLOGY FOR SEDIMENT CONTROL IN URBAN AREAS,
W71-04148 04D

THE CONTROL OF EROSION AND SEDIMENT IN HIGHWAY CONSTRUCTION,
W71-04149 04D

SEEDLINGS
PERENNATION IN ASTRAGALUS LENTIGINOSUS AND TRIDENS PULCHELLUS IN RELATION TO RAINFALL,
W71-04299 02I

SEMIARID CLIMATES
PROBLEMS OF DETERMINING EVAPOTRANSPIRATION IN THE SEMI-ARID TROPICS ILLUSTRATED WITH REFERENCE TO THE SUDAN,

W71-04236 02D

SEMIARID LANDS
MINERALOGY OF SOME ARID AND SEMIARID LAND SOILS OF IRAQ,
W71-04061 02G

SEMIPERMEABLE MEMBRANES
WATER TRANSPORT THROUGH PLASTICIZED MEMBRANES,
W71-03912 03A

THE STRUCTURE AND MORPHOLOGY OF INORGANIC MEMBRANES,
W71-04224 03A

SENSITIVITY
THE ELECTRON CAPTURE DETECTOR IN THE ANALYSIS OF CHLORINATED HYDROCARBON PESTICIDES IN TISSUES WITH AND WITHOUT CLEAN-UP,
W71-04214 05A

SENSORS
UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME I. STATE-OF-THE-ART OF OCEANOGRAPHIC AND METEOROLOGICAL SENSORS, TUTORIAL DISCUSSION,
W71-04009 07B

UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME II. STATE-OF-THE-ART OF OCEANOGRAPHIC AND METEOROLOGICAL SENSORS, CATALOG,
W71-04010 07B

UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME III. THE SURVIVAL ENVIRONMENT FOR OCEANOGRAPHIC AND METEOROLOGICAL SENSORS,
W71-04011 07B

UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME IV. THE FORMATTING AND TRANSMISSION OF DATA FROM OCEANOGRAPHIC SENSORS,
W71-04012 07B

UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME V. ANALYSIS OF APPLYING STANDARDIZATION TECHNIQUES TO OCEANOGRAPHIC SENSORS,
W71-04013 07B

UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME VI. TEST REQUIREMENTS FOR OCEANOGRAPHIC AND METEOROLOGICAL SENSORS,
W71-04014 07B

SEPARATION TECHNIQUES
POROUS TUBULET SUPPORTS FOR DESALINATION BARRIERS,
W71-03911 03A

SESTON
PHYTOPLANKTON, SESTON, AND DISSOLVED ORGANIC CARBON IN THE LITTLE MIAMI RIVER AT CINCINNATI, OHIO,
W71-04209 05A

SEWAGE
ENGINEERING EVALUATION OF FACTORS AFFECTING QUALITY OF WATER SOURCES AVAILABLE FOR SALINE WATER CONVERSION PLANTS,
W71-03916 03A

SEWAGE DISPOSAL
A LONG-TERM PLAN FOR SEWERAGE DEVELOPMENT IN THE JOHANNESBURG REGION,
W71-03895 05G

POWER OF CITIES AND TOWNS TO PROVIDE DRAINAGE AND SEWAGE FACILITIES.
W71-04081 06E

CITYCO REALTY CO V. MAYOR, COUNSELOR, AND ALDERMAN OF ANNAPOLIS (RIGHT OF CITY TO DISCHARGE SEWAGE INTO STREAM).
W71-04319 06E

SEWAGE TREATMENT
FLORIDA FIRM USES GAMMA RAYS TO POLISH SEWAGE PLANT EFFLUENT.
W71-03890 05D

COMPUTER DESIGN OF SEWAGE TREATMENT PLANTS,
W71-03893 05D

DESIGN OF ACTIVATED CARBON ADSORPTION BEDS,
W71-03897 05D

SANTEE PROJECT CONTINUES TO SHOW THE WAY,
W71-03904 05D

SEWERAGE
A LONG-TERM PLAN FOR SEWERAGE DEVELOPMENT IN THE JOHANNESBURG REGION,
W71-03895 05G

SEWERS
A LONG-TERM PLAN FOR SEWERAGE DEVELOPMENT IN THE JOHANNESBURG REGION,
W71-03895 05G

SHAFTS
DETERMINING THE CRITICAL SPEEDS OF HYDRAULIC UNIT SHAFTS,
W71-03996 08C

SHONTO PLATEAU(ARIZONA)
CLIMATE AND OVERGRAZING ON THE SHONTO PLATEAU, ARIZONA,
W71-04064 03F

SHORE PROTECTION
GREAT LAKES SHORELAND MANAGEMENT AND EROSION DAMAGE CONTROL FOR MICHIGAN.
W71-03908 02H

SHORELAND MANAGEMENT
GREAT LAKES SHORELAND MANAGEMENT AND EROSION DAMAGE CONTROL FOR MICHIGAN.
W71-03908 02H

SHORES
VARIATION IN THE LEVEL OF THE CLIFF/SHORE PLATFORM JUNCTION ALONG THE SOUTH COAST OF GREAT BRITAIN,
W71-03952 02J

HUNTER V VAN KEUREN (BOUNDARY DISPUTE AT LAKESHORE).
W71-04276 06E

SIEROZEMS
MINERALOGY OF SOME ARID AND SEMIARID LAND SOILS OF IRAQ,
W71-04061 02G

SIERRA NEVADA
DO CONTOUR TRENCHES REDUCE WET-MANTLE FLOOD PEAKS,
W71-04262 04A

SIEVE ANALYSIS
ON THE ACCURACY OF BED-MATERIAL SAMPLING,
W71-04132 02J

SIMULATION ANALYSIS
THE EVALUATION OF THE COST OF ALTERNATIVE STRATEGIES FOR AIR POLLUTION CONTROL,
W71-03859 06A

PLANNING FOR THE OSWEGO BASIN IN NEW YORK--A SYSTEMS APPROACH,
W71-03860 06A

A WATER-QUALITY SIMULATION MODEL FOR WELL-MIXED ESTUARIES AND COASTAL SEAS VOLUME I, PRINCIPLES OF COMPUTATION,
W71-04038 06A

A NONLINEAR MULTIPLE RESERVOIR WATER RESOURCES MODEL WITH MULTIPLE PURPOSES,
W71-04044 04A

CHAIN MODEL OF RIVER MEANDERS,
W71-04124 02E

FINITE AQUIFERS CHARACTERISTIC RESPONSES AND APPLICATIONS,
W71-04126 02F

A SIMPLE CASCADE WATERSHED MODEL,
W71-04181 02A

HYDROGRAPH SYNTHESIS FOR WATERSHED SUBZONES FROM MEASURED URBAN PARAMETERS,
W71-04184 04C

SIMULATION MODEL
APPLICATION OF INDUSTRIAL DYNAMICS CONCEPTS TO DECISION MAKING IN ENVIRONMENTAL MANAGEMENT,
W71-04025 05G

SLOPE GRADIENT
INFILTRATION AND SOIL EROSION AS INFLUENCED BY VEGETATION AND SOIL IN NORTHERN UTAH,
W71-04260 02J

SLUDGE DIGESTION
ANAEROBIC DIGESTION FAILURES,
W71-03891 05D

THE EFFECT OF SHORT-TERM TEMPERATURE VARIATIONS ON METHANE PRODUCTION,
W71-04077 05D

SLUDGE TREATMENT
METABOLIC RESPONSE OF ACTIVATED SLUDGE TO SODIUM PENTACHLOROPHENOL,
W71-04088 05D

SMALL WATERSHEDS
ANALYSIS OF SNOW MELT FLOODS,
W71-04179 02E

DO CONTOUR TRENCHES REDUCE WET-MANTLE FLOOD PEAKS,
W71-04262 04A

SNAKE RIVER
SUPERFARMS VS. SAGEBRUSH NEW IRRIGATION DEVELOPMENTS ON THE SNAKE RIVER PLAIN,
W71-04056 03F

SNOW
ARTILLERY CONTROL OF AVALANCHES ALONG MOUNTAIN HIGHWAYS,
W71-04258 02C

SNOW FENCES
THE HYDROLOGY OF SAGEBRUSH LANDS AND THE MANAGEMENT OF BLOWING SNOW,
W71-04248 03B

SUMMARY OF SNOW RESEARCH BY THE ROCKY MOUNTAIN FOREST AND RANGE EXPERIMENT STATION AT LARAMIE, WYOMING.,
W71-04249 02C

SNOW MANAGEMENT
THE HYDROLOGY OF SAGEBRUSH LANDS AND THE MANAGEMENT OF BLOWING SNOW,
W71-04248 03B

SUMMARY OF SNOW RESEARCH BY THE ROCKY MOUNTAIN FOREST AND

RANGE EXPERIMENT STATION AT LARAMIE, WYOMING.,
W71-04249 02C

SNOW SURVEYS
SOME PROBLEMS OF DETERMINING THE WATER EQUIVALENT OF THE SNOW COVER,
W71-04173 02C

ESTIMATION OF THE WATER SUPPLY FROM SNOW COVER IN THE SOUTHERN PART OF THE GERMAN D. R. IN SPRING 1965,
W71-04180 02C

SNOWMELT
VARIATION OF THE TRITIUM AND OXYGEN-18 CONTENT IN PRECIPITATION AND SNOWPACK IN A REPRESENTATIVE BASIN IN CZECHOSLOVAKIA,
W71-04135 02A

SNOWMELT AND WATER YIELD FROM SNOW COVER,
W71-04171 02C

A METHOD FOR THE COMPUTATION OF WATER YIELD FROM SNOW DURING SNOWMELT PERIOD,
W71-04172 02C

SOME RESULTS OF INVESTIGATION AND REPRESENTATION OF SNOW SUPPLY AND THE MELTING OF SNOW,
W71-04174 02C

RUNOFF CONDITIONS DURING SNOW THAWING IN THE MORAVIAN-SILESIAN BESKIDS,
W71-04175 02C

METHODS OF SNOWMELT MAXIMUM DISCHARGE COMPUTATION IN CASES OF ABSENCE OR INSUFFICIENCY OF HYDROMETRIC DATA,
W71-04177 02C

A METHOD FOR THE CALCULATION OF SPRING FLOODS,
W71-04178 02E

ANALYSIS OF SNOW MELT FLOODS,
W71-04179 02E

ESTIMATION OF THE WATER SUPPLY FROM SNOW COVER IN THE SOUTHERN PART OF THE GERMAN D. R. IN SPRING 1965,
W71-04180 02C

SNOWPACKS
VARIATION OF THE TRITIUM AND OXYGEN-18 CONTENT IN PRECIPITATION AND SNOWPACK IN A REPRESENTATIVE BASIN IN CZECHOSLOVAKIA,
W71-04135 02A

DEUTERIUM MEASUREMENTS ON SNOW SAMPLES FROM THE ALPS,
W71-04136 02A

SOME RESULTS OF INVESTIGATION AND REPRESENTATION OF SNOW SUPPLY AND THE MELTING OF SNOW,
W71-04174 02C

SOCIAL ASPECTS
FEEDING A DESERT CITY ANTOFAGASTA, CHILE,
W71-04055 03F

SOCIAL CHANGE
SUPERFARMS VS. SAGEBRUSH NEW IRRIGATION DEVELOPMENTS ON THE SNAKE RIVER PLAIN,
W71-04056 03F

SOCIAL COSTS
PRIVATE AND SOCIAL COSTING AND PRICING AS DECISION DETERMINANTS,
W71-03863 06C

PRIVATE AND SOCIAL COSTING AS DECISION DETERMINANTS IN WATER RESOURCES,
W71-03864 06B

SOCIAL IMPACT
NEW APPROACHES TO IRRIGATED FARMING IN THE SUDAN ORGANIZATION AND MANAGEMENT,
W71-04231 03F

SOCIAL OBJECTIVES
INCORPORATING SOCIAL OBJECTIVES IN SYSTEMS MODELS,
W71-03862 06B

SOCIO-ECONOMIC PATTERNS
SPATIAL PATTERNS OF SOCIO-ECONOMIC STRUCTURE IN INDIA,
W71-04234 06B

SODIUM PENTACHLOROPHENOL
METABOLIC RESPONSE OF ACTIVATED SLUDGE TO SODIUM PENTACHLOROPHENOL,
W71-04088 05D

SOIL ANALYSIS
MINERALOGY OF SOME ARID AND SEMIARID LAND SOILS OF IRAQ,
W71-04061 02G

SOIL CHEMISTRY
ADSORPTION OF BORON BY FERROMAGNESIAN MINERALS AND MAGNESIUM HYDROXIDE,
W71-03939 02G

PEDOGENIC DISTRIBUTION OF ZINC IN MOLLISOLS AND ASSOCIATED ENTISOLS IN NEBRASKA,
W71-03940 02G

SOLUBILITY AND AVAILABILITY OF SORBED SULFATE IN HAWAIIAN SOILS,
W71-03941 02G

THE DIFFUSION OF COPPER, MANGANESE, AND ZINC AS AFFECTED BY CONCENTRATION, CLAY MINERALOGY, AND ASSOCIATED ANIONS,
W71-03942 02G

SOIL EROSION
GREAT LAKES SHORELAND MANAGEMENT AND EROSION DAMAGE CONTROL FOR MICHIGAN.
W71-03908 02H

SOIL FORMATION
MINERALOGY OF SOME ARID AND SEMIARID LAND SOILS OF IRAQ,
W71-04061 02G

SOIL MANAGEMENT
THE SAM SIMON WATERSHED SHRUB CONTROL,
W71-04058 03F

SOIL MOISTURE
INVESTIGATION OF THE WATER REGIME OF SOILS IN THE AERATION ZONE, THEIR FREEZING, WATER-PHYSICAL AND FILTRATION PROPERTIES,
W71-03964 02G

THE DEVELOPMENT OF EGGS OF THE RED LOCUST NOMADACRIS SEPTEMFASCIATA (SERV.), AND THE AFRICAN MIGRATORY LOCUST, LOCUSTA MIGRATORIA MIGRATORIODES (R. AND F.), AND ITS INTERRUPTION UNDER PARTICULAR CONDITIONS OF HUMIDITY,
W71-04297 03F

PERENNATION IN ASTRAGALUS LENTIGINOSUS AND TRIDENS PULCHELLUS IN RELATION TO RAINFALL,
W71-04299 02I

SOIL MOISTURE METERS
MEASUREMENT OF WATER POTENTIAL WITH THERMOCOUPLE PSYCHROMETERS CONSTRUCTION AND APPLICATIONS,
W71-04237 02I

SOIL FREEZING DETERMINED WITH FOUR TYPES OF WATER-FILLED TUBES,
W71-04251 07B

SOIL PHYSICAL PROPERTIES
INVESTIGATION OF THE WATER REGIME OF SOILS IN THE AERATION ZONE, THEIR FREEZING, WATER-PHYSICAL AND FILTRATION PROPERTIES,
W71-03964 02G

ROOT DEVELOPMENT OF TWO COMMON SPECIES IN DIFFERENT HABITATS IN THE MEDITERRANEAN SUBREGION IN EGYPT,
W71-04300 02I

SOIL PROPERTIES
INFILTRATION AND SOIL EROSION AS INFLUENCED BY VEGETATION AND SOIL IN NORTHERN UTAH,
W71-04260 02J

SOIL SLIPS
THE EFFECT OF VEGETATION CONVERSION AND FLOOD DISCHARGE ON STREAM CHANNEL GEOMETRY THE CASE OF SOUTHERN CALIFORNIA WATERSHEDS,
W71-04230 04D

SOIL STABILITY
FOURWING SALTBUSH CAN BE FIELD PLANTED SUCCESSFULLY,
W71-04247 04A

SOIL TEMPERATURE
SOIL FREEZING DETERMINED WITH FOUR TYPES OF WATER-FILLED TUBES,
W71-04251 07B

SOIL TESTS
PEDOGENIC DISTRIBUTION OF ZINC IN MOLLISOLS AND ASSOCIATED ENTISOLS IN NEBRASKA,
W71-03940 02G

SOIL TYPES
SPRAY IRRIGATION OF WASTES FROM THE MANUFACTURE OF HARDBOARD,
W71-03886 05D

SOIL WATER
THE DIFFUSION OF COPPER, MANGANESE, AND ZINC AS AFFECTED BY CONCENTRATION, CLAY MINERALOGY, AND ASSOCIATED ANIONS,
W71-03942 02G

MINERALOGY OF SOME ARID AND SEMIARID LAND SOILS OF IRAQ,
W71-04061 02G

MEASUREMENT OF WATER POTENTIAL WITH THERMOCOUPLE PSYCHROMETERS CONSTRUCTION AND APPLICATIONS,
W71-04237 02I

WATER POTENTIAL MEASUREMENTS IN TRESS,
W71-04238 02I

ASPEN SPROUT PRODUCTION AND WATER USE,
W71-04241 02I

SOIL MOISTURE DEPLETION AND ESTIMATED EVAPOTRANSPIRATION ON UTAH MOUNTAIN WATERSHED,
W71-04242 02D

SOIL FREEZING DETERMINED WITH FOUR TYPES OF WATER-FILLED TUBES,
W71-04251 07B

INFLUENCE OF MANAGEMENT AND ENVIRONMENTAL FACTORS ON EXTENT

OF SOIL WATER DEPLETION BY SPRING WHEAT,
W71-04303 03F

SOIL WATER MOVEMENT
INVESTIGATION OF THE WATER REGIME OF SOILS IN THE AERATION ZONE, THEIR FREEZING, WATER-PHYSICAL AND FILTRATION PROPERTIES,
W71-03964 02G

SATURATION-UNSATURATION TRANSITION IN INFILTRATION TO A NON-UNIFORM SOIL PROFILE,
W71-04066 02G

SIMILITUDE CONCEPT IN PARTIALLY SATURATED SOILS,
W71-04131 02G

WATER MOVEMENT IN THE UNSATURATED ZONE OF HIGH AND LOW PERMEABILITY STRATA BY MEASURING NATURAL TRITIUM,
W71-04138 02A

SOIL WATER POTENTIAL
MEASUREMENT OF WATER POTENTIAL WITH THERMOCOUPLE PSYCHROMETERS CONSTRUCTION AND APPLICATIONS,
W71-04237 02I

SOIL WATER RELATIONS
MEASUREMENT OF WATER POTENTIAL WITH THERMOCOUPLE PSYCHROMETERS CONSTRUCTION AND APPLICATIONS,
W71-04237 02I

SOILS
ADSORPTION OF BORON BY FERROMAGNESIAN MINERALS AND MAGNESIUM HYDROXIDE,
W71-03939 02G

SOLUBILITY AND AVAILABILITY OF SORBED SULFATE IN HAWAIIAN SOILS,
W71-03941 02G

LITERATURE SURVEY OF MOISTURE MIGRATION IN SOILS DUE TO THERMAL GRADIENTS,
W71-04000 02C

DRAINAGE LINE DEPTH,
W71-04016 08D

SOIL-WATER-PLANT RELATIONSHIPS
MEASUREMENT OF WATER POTENTIAL WITH THERMOCOUPLE PSYCHROMETERS CONSTRUCTION AND APPLICATIONS,
W71-04237 02I

WATER POTENTIAL MEASUREMENTS IN TRESS,
W71-04238 02I

LEAF SAMPLER FOR RELATIVE WATER CONTENT MEASUREMENTS DESIGN AND APPLICATION,
W71-04239 02I

FORMATION OF PHYTOGENIC HILLOCKS II. ROOTING HABIT OF PLANTS FORMING PHYTOGENIC HILLOCKS,
W71-04295 02I

ROOT DEVELOPMENT OF TWO COMMON SPECIES IN DIFFERENT HABITATS IN THE MEDITERRANEAN SUBREGION IN EGYPT,
W71-04300 02I

SOLAR RADIATION
PREDICTION OF SOLAR AND ATMOSPHERIC RADIATION FOR ENERGY BUDGET STUDIES OF LAKES AND STREAMS,
W71-04020 02B

SOLVENTS
THE EFFECT OF SOME SOLVENTS ON LOWER WATER ANIMALS AND ON FISHES,
W71-03854 05C

SONORAN DESERT
RESPONSES OF NATIVE AND MIGRANT DESERT RESIDENTS TO ARID HEAT,
W71-04301 02I

SORGHUM
ELEVATION AND TEMPERATURE EFFECTS ON SEVERITY OF MAIZE DWARF MOSAIC VIRUS IN SORGHUM,
W71-04060 03F

SORPTION
SOLUBILITY AND AVAILABILITY OF SORBED SULFATE IN HAWAIIAN SOILS,
W71-03941 02G

SORTING(SEDIMENTS)
A GEOCHEMICAL TREND IN SILICON-ALUMINUM-IRON RATIOS AND THE CLASSIFICATION OF CLASTIC SEDIMENTS,
W71-03945 02K

SOUTH AFRICA
SOME PROBLEMS OF A KARST AREA IN THE EASTERN TRANSVAAL, SOUTH AFRICA,
W71-04053 02G

SOUTH AUSTRALIA
ASPECTS OF THE SOUTH AUSTRALIAN CITRUS INDUSTRY,
W71-04051 03F

SOUTH CAROLINA
CHICK SPRINGS WATER CO V STATE HIGHWAY DEP'T (STATE'S LIABILITY FOR INVERSE CONDEMNATION WHEN INADEQUATE CULVERT CAUSES FLOODING).
W71-04197 06E

SOUTHEAST U
PLAN FOR DEVELOPMENT OF THE LAND AND WATER RESOURCES OF THE SOUTHEAST UNITED STATES RIVER BASINS.
W71-04266 06E

SPECTROCHEMICAL ANALYSIS
A DIRECT-READING SPECTROCHEMICAL PROCEDURE FOR THE MEASUREMENT OF NINETEEN MINOR ELEMENTS IN NATURAL WATER,
W71-04211 05A

SPECTROPHOTOMETRY
SPECTROPHOTOMETRIC DETERMINATION OF THIOCYANATE AND OXALATE,
W71-03928 05A

SPECTROPHOTOMETRIC DETERMINATION OF CHLORATE ION,
W71-03994 02K

SPECTROSCOPY
LABORATORY GUIDE FOR THE IDENTIFICATION ON PETROLEUM PRODUCTS,
W71-04199 05A

SPOIL BANKS
MENTELSON V STATE (LIABILITY FOR FLOOD DAMAGE RESULTING FROM STATE'S OBSTRUCTION OF DRAINAGE CHANNEL).
W71-04018 06E

SPORT FISHING
ASPECTS OF PLANNING, EVALUATION, AND DECISION-MAKING IN SPORT FISHERY MANAGEMENT.
W71-04271 06B

SPRINKLER IRRIGATION
INFLUENCE OF LOW RATES OF WATER APPLICATION BY SPRINKLERS ON THE MICROCLIMATE,
W71-03925 02D

STABILIZATION
DESIGN CONSTRUCTION AND MAINTENANCE OF WASTE STABILIZATION LAGOONS,
W71-03896 05D

STAGE-DISCHARGE RELATIONS
HYDRAULIC RESISTANCE AND FORMULA FOR COMPUTING THE AVERAGE FLOW VELOCITY OF MOUNTAIN RIVERS,
W71-03961 02E

WATER DISCHARGE TRAVEL TIME COEFFICIENTS,
W71-03973 02E

THE UNIVERSALISATION OF THE CO-ORDINATES OF LOGARITHMIC WEIR PROFILES,
W71-04127 07B

THE TRAPEZOIDAL FREE OVERFALL,
W71-04128 08B

EXPERIMENTAL STUDIES ON LINEAR PROPORTIONAL WEIRS WITH TRIANGULAR BOTTOMS,
W71-04129 08B

STATE GOVERNMENTS
INSURING MAXIMUM BENEFICIAL USE OF WATER THROUGH LEGISLATION,
W71-04099 06E

WHITE V STATE (VALIDITY OF GRANT OF SUBMERGED STATE LANDS).
W71-04350 06E

STATES
PEOPLE V ZORA REALTY CO (ATTEMPT TO DECLARE PATENT IN SUBMERGED LANDS VOID FOR NONUSE).
W71-04348 06E

STATISTICAL METHODS
COMPARISON OF THE DESCRIPTORS OF SEDIMENT GRAIN-SIZE DISTRIBUTIONS,
W71-03947 02J

EVALUATION OF MAXIMUM RAINFALL DISCHARGE FROM A REGION OF DEFICIENT RAINFALL DATA,
W71-03978 02E

PROBABLE FLOOD DISCHARGES OF THE PO RIVER TRIBUTARIES,
W71-03987 02E

ON THE ACCURACY OF BED-MATERIAL SAMPLING,
W71-04132 02J

ANALYSIS OF RAINFALL OVER A SMALL AREA,
W71-04155 02B

SPATIAL PATTERNS OF SOCIO-ECONOMIC STRUCTURE IN INDIA,
W71-04234 06B

STATISTICS
BUREAU OF RECLAMATION APPROPRIATION ACTS AND ALLOTMENTS 1966 STATISTICAL SUPPLEMENT.
W71-04103 09D

ON THE ACCURACY OF BED-MATERIAL SAMPLING,
W71-04132 02J

STEADY STATE CONDITIONS
MODELING AND OPTIMIZATION OF WATER RESOURCES SYSTEMS - PHASE I,
W71-04043 06A

STOCHASTIC HYDROLOGIC SYSTEMS
ANALYSIS OF STOCHASTIC HYDROLOGIC SYSTEMS,
W71-03869 02A

STOCHASTIC PROCESSES
ANALYSIS OF STOCHASTIC HYDROLOGIC SYSTEMS,
W71-03869 02A

OPTIMAL ALLOCATION OF STOCHASTIC WATER SUPPLY,
W71-04028 03B

SUPERPOSITION OF SUBMONTHLY FLOWS IN STOCHASTIC HYDROLOGY,
W71-04040 02E

MODELING AND OPTIMIZATION OF WATER RESOURCES SYSTEMS - PHASE I,
W71-04043 06A

STORM DRAINS
1939 RUNOFF INSTRUCTIONS FOR DESIGN OF STORM DRAINS, OFFICE STANDARD NO. 71.
W71-03906 08A

STORM RUNOFF
1939 RUNOFF INSTRUCTIONS FOR DESIGN OF STORM DRAINS, OFFICE STANDARD NO. 71.
W71-03906 08A

METHOD OF ESTIMATING STORM RUNOFF FROM SMALL DRAINAGE BASINS,
W71-03992 02E

STORM SEWERS
1939 RUNOFF INSTRUCTIONS FOR DESIGN OF STORM DRAINS, OFFICE STANDARD NO. 71.
W71-03906 08A

STORM STRUCTURE
CLOUD SEEDING POTENTIALITIES IN LOS ANGELES COUNTY.
W71-03903 03B

STORM WATER POLLUTION CONTROL
A MULTI-PHASIC COMPONENT STUDY TO PREDICT STORM WATER POLLUTION FROM URBAN AREAS,
W71-03917 05C

STORM WATER RUNOFF
A MULTI-PHASIC COMPONENT STUDY TO PREDICT STORM WATER POLLUTION FROM URBAN AREAS,
W71-03917 05C

STRATIFICATION
EUTROPHICATION OF WATER RESOURCES OF NEW YORK STATE, OBSERVATIONS ON NUTRIENT LIMITATION ON SUMMER PHYTOPLANKTON IN CAYUGA LAKE, 1967 AND 1968,
W71-03923 02H

STREAM DEPLETION
THE PUMPED WELL,
W71-04292 04B

STREAM EROSION
SEDIMENT TRANSPORT IN DEGRADING RIVERS,
W71-03995 02J

STREAM GAGES
THE UNIVERSALISATION OF THE CO-ORDINATES OF LOGARITHMIC WEIR PROFILES,
W71-04127 07B

EXPERIMENTAL STUDIES ON LINEAR PROPORTIONAL WEIRS WITH TRIANGULAR BOTTOMS,
W71-04129 08B

STREAM IMPROVEMENT
STREAM QUALITY MODELING BY QUASILINEARIZATION,
W71-04045 05F

STREAMFLOW
THE RELATIONSHIP BETWEEN SUMMER LOW FLOWS AND GEOLOGY IN NORTHLAND, NEW ZEALAND,
W71-03931 02A

A PROPOSED STREAMFLOW DATA PROGRAM FOR NEW YORK,
W71-03933 07A

MAP OF TOTAL STREAMFLOW FROM THE TERRITORY OF THE SOVIET UNION,
W71-03960 02E

SUPERPOSITION OF SUBMONTHLY FLOWS IN STOCHASTIC HYDROLOGY,
W71-04040 02E

STREAMFLOW DATA PROGRAM(N
A PROPOSED STREAMFLOW DATA PROGRAM FOR NEW YORK,
W71-03933 07A

STREAMFLOW FORECASTING
COMPUTATION OF FLOW IN GLACIER-FED RIVERS,
W71-03975 02E

EVALUATION OF MAXIMUM RAINFALL DISCHARGE FROM A REGION OF DEFICIENT RAINFALL DATA,
W71-03978 02E

SNOWMELT AND WATER YIELD FROM SNOW COVER,
W71-04171 02C

A METHOD FOR THE COMPUTATION OF WATER YIELD FROM SNOW DURING SNOWMELT PERIOD,
W71-04172 02C

METHODS OF SNOWMELT MAXIMUM DISCHARGE COMPUTATION IN CASES OF ABSENCE OR INSUFFICIENCY OF HYDROMETRIC DATA,
W71-04177 02C

ESTIMATION OF THE WATER SUPPLY FROM SNOW COVER IN THE SOUTHERN PART OF THE GERMAN D. R. IN SPRING 1965,
W71-04180 02C

STREAMFLOW MAPS
MAP OF TOTAL STREAMFLOW FROM THE TERRITORY OF THE SOVIET UNION,
W71-03960 02E

STREAMS
HALEY V DAVENPORT (CONSTITUTIONALITY OF STATUTE AUTHORIZING TRESPASS TO DRAIN SWAMPS AND PONDS).
W71-04341 06E

STRIP MINES
WASTE WATER RESULTING FROM THE CONCENTRATION OF LOW GRADE IRON ORE,
W71-04083 05D

STRONTIUM RADIOISOTOPES
MOVEMENT OF ALGAL- AND FUNGAL-BOUND RADIOSTRONTUM AS CHELATE COMPLEXES IN A CALCAREOUS SOIL,
W71-04067 05B

STUBBLE MULCHING
MICROBIAL POPULATIONS IN STUBBLE-MULCHED SOIL,
W71-04068 02G

SUBGLACIAL RELIEF
RECONSTRUCTION OF SUBGLACIAL RELIEF FROM RADIO ECHO SOUNDING RECORDS,
W71-04112 02C

SUBHUMID CLIMATES
SOME ASPECTS OF DROUGHT CLIMATOLOGY OF THE DRY SUBHUMID ZONES OF SOUTH INDIA,
W71-04298 02B

SUBSURFACE RUNOFF
THE RELATIONSHIP BETWEEN SUMMER LOW FLOWS AND GEOLOGY IN NORTHLAND, NEW ZEALAND,
W71-03931 02A

SUBSURFACE WATERS
RIGHTS TO SURFACE AND SUBSURFACE WATER IN MASSACHUSETTS.
W71-03882 06E

SUBTILLING
MICROBIAL POPULATIONS IN STUBBLE-MULCHED SOIL,
W71-04068 02G

SUDAN
THE LOCATION OF LAND USE TYPES THE NILE VALLEY IN NORTHERN SUDAN,
W71-04228 04A

NEW APPROACHES TO IRRIGATED FARMING IN THE SUDAN ORGANIZATION AND MANAGEMENT,
W71-04231 03F

PROBLEMS OF DETERMINING EVAPOTRANSPIRATION IN THE SEMI-ARID TROPICS ILLUSTRATED WITH REFERENCE TO THE SUDAN,
W71-04236 02D

SULFATES
ACTION OF IRON SALTS IN SOLUTION ON GOLDFISH,
W71-03851 05C

SOLUBILITY AND AVAILABILITY OF SORBED SULFATE IN HAWAIIAN SOILS,
W71-03941 02G

SULFITES
PROTOTYPE STUDIES OF COMBINED TREATMENT OF WASTES FROM 22 TANNERIES AND TWO MUNICIPALITIES,
W71-03892 05D

SULFUR COMPOUNDS
PROTOTYPE STUDIES OF COMBINED TREATMENT OF WASTES FROM 22 TANNERIES AND TWO MUNICIPALITIES,
W71-03892 05D

SUPPORT TUBES
POROUS TUBULET SUPPORTS FOR DESALINATION BARRIERS,
W71-03911 03A

SURFACE CHEMISTRY
SURFACE CHEMISTRY STUDIES ON THE BAY OF PANAMA,
W71-04001 02L

SURFACE RUNOFF
SCANLAN V HOPKINS (LEGAL CONSEQUENCES OF AGREEMENT BY GRANTOR TO CONSTRUCT CULVERT OVER NATURAL WATERCOURSE).
W71-04314 06E

SURFACE WATERS
RIGHTS TO SURFACE AND SUBSURFACE WATER IN MASSACHUSETTS.
W71-03882 06E

QUALITY OF RUNOFF FROM DIVERSIFIED URBAN WATERSHEDS,
W71-03929 05A

QUALITY OF SURFACE WATERS OF THE UNITED STATES, 1965 PARTS 7 AND 8. LOWER MISSISSIPPI RIVER BASIN AND WESTERN GULF OF MEXICO BASINS.
W71-04048 02K

CATALOG OF INFORMATION ON WATER DATA, EDITION 1970-INDEX TO SURFACE WATER SECTION.

W71-04151 07C

THE BACKGROUND CONCENTRATIONS OF COPPER, LEAD, AND ZINC IN STREAMS OF THE 'NEW LEAD BELT', MISSOURI,
W71-04182 05A

SURFACE-ACTIVE SUBSTANCES
SURFACE CHEMISTRY STUDIES ON THE BAY OF PANAMA,
W71-04001 02L

SURFACE-GROUNDWATER RELATIONSHIPS
SOME CHARACTERISTICS OF THE THERMAL REGIME OF RIVERS IN THE DANUBE AND DNIESTER BASINS,
W71-03974 02K

SURFACTANTS
TREATMENT OF ACID MINE DRAINAGE BY FOAM SEPARATION,
W71-04188 05D

WETTING AGENT FAILS TO CURB EROSION FROM BURNED WATERSHED,
W71-04250 04D

SURPLUS WATER
KIRK V PROVIDENCE MILL CO (SURPLUS WATER RIGHTS SUBJECT TO STATE'S RIGHT TO ABANDON AND DRAIN CANAL).
W71-04344 06E

SURVEYS
ECORSE RIVER WATER QUALITY STUDY, MAY-JULY, 1969.
W71-03907 05B

1965 RESERVOIR LAND USE SURVEYS FIELD REPORT AND PROCEDURAL MANUAL,
W71-04039 04A

SUSPENDED LOAD
THE PERIODIC CYCLE OF PARTICULATE MATTER IN A SHALLOW, TEMPERATE ESTUARY,
W71-03943 02L

SWEATING
RESPONSES OF NATIVE AND MIGRANT DESERT RESIDENTS TO ARID HEAT,
W71-04301 02I

SWITZERLAND
DEUTERIUM MEASUREMENTS ON SNOW SAMPLES FROM THE ALPS,
W71-04136 02A

SYMBIOSIS
RESPIRATORY RELATIONSHIPS OF A SYMBIOTIC ALGAL-BACTERIAL CULTURE FOR WASTE WATER NUTRIENT REMOVAL,
W71-04079 05D

SYNOPTIC ANALYSIS
DISTRIBUTION OF HYDROGEN ISOTOPES IN CANADIAN WATERS,
W71-04134 02A

QUANTITATIVE REGIONAL PREDICTION OF RAINFALL IN ECAFE REGIONS,
W71-04152 02B

VERTICAL VELOCITY AND RAINFALL COMPUTATION,
W71-04153 02B

RAIN FROM TROPICAL CYCLONES AND TROUGH-TYPE SYSTEMS,
W71-04156 02B

SOME EXAMPLES OF HEAVY RAINFALL IN JAPAN,
W71-04166 02B

THE PROBLEM OF FLOOD PREDICTION ON THE EAST COAST OF WEST MALAYSIA,
W71-04167 02B

HEAVY RAINFALL IN PAKISTAN AND ITS ASSOCIATED FLOOD,
W71-04168 02B

HEAVY RAINFALL AND ASSOCIATED FLOODS IN WEST PAKISTAN,
W71-04169 02B

THE CIRCULATION PATTERN OVER SINGAPORE AND THE EAST COAST OF WEST MALAYSIA DURING JANUARY AND FEBRUARY 1967 COMPARED WITH THAT OF JANUARY AND FEBRUARY 1968,
W71-04170 02B

SYNTHETIC HYDROLOGY
CONSTRUCTION OF THE UNIT HYDROGRAPH BY THE METHOD OF HYDROLOGIC ANALOGY (FRENCH),
W71-03981 02E

SYSTEMS ANALYSIS
NATURAL RESOURCE SYSTEMS MODELS IN DECISION MAKING.
W71-03855 06A

RESOURCE SYSTEMS MODELS IN DECISION MAKING,
W71-03856 06A

SYSTEMS ANALYSIS FOR WATER SUPPLY AND POLLUTION CONTROL,
W71-03857 06A

PLANNING FOR THE OSWEGO BASIN IN NEW YORK--A SYSTEMS APPROACH,
W71-03860 06A

INSTITUTIONAL DESIGN FOR WATER QUALITY MANAGEMENT THE IMPLICATIONS OF A SYSTEMS APPROACH FOR LEGAL AND ADMINISTRATIVE ARRANGEMENTS,
W71-03867 06E

A REVIEW OF THE 1969 LITERATURE ON WASTE WATER AND WATER POLLUTION CONTROL, ADMINISTRATION SYSTEMS ANALYSIS,
W71-03879 05G

WATER RESOURCES SYSTEMS ENGINEERING,
W71-03885 06A

DESIGN CAPACITIES TO ACCOMMODATE FORECAST UNDERTAINTIES,
W71-04026 06A

PROCEEDINGS OF A SEMINAR ON RESERVOIR SYSTEMS ANALYSIS, 4-6 NOVEMBER 1969.
W71-04034 04A

TANNERY WASTES
PROTOTYPE STUDIES OF COMBINED TREATMENT OF WASTES FROM 22 TANNERIES AND TWO MUNICIPALITIES,
W71-03892 05D

TASTE
A CASE STUDY OF MICROORGANIC CONTAMINANTS IN RIVER WATER,
W71-04119 05A

TECHNIQUES
MODELING AND OPTIMIZATION OF WATER RESOURCES SYSTEMS - PHASE I,
W71-04043 06A

TECHNOLOGY
CONTINENTAL SHELF LAW OUTDISTANCED BY SCIENCE AND TECHNOLOGY,
W71-04100 06E

TELEMETRY
REMOTE GROUNDWATER LEVEL METER FOR BOG STATIONS,
W71-03966 07B

TEMPERATURE
INFLUENCE OF TEMPERATURE AND PHOTOPERIOD ON GROWTH, FOOD CONSUMPTION AND FOOD CONVERSION EFFICIENCY OF CHANNEL CATFISH,
W71-03920 05C

PREDICTION OF SOLAR AND ATMOSPHERIC RADIATION FOR ENERGY BUDGET STUDIES OF LAKES AND STREAMS,
W71-04020 02B

A NEW APPROACH TO THE CLASSIFICATION OF CLIMATE,
W71-04235 02B

TENNESSEE
PUBLIC WATER POLICY IN TENNESSEE.
W71-04308 06E

WATER USE IN TENNESSEE, PART D - SUMMARY,
W71-04324 06D

TENNESSEE VALLEY AUTHORITY PROJECT
ESTABLISHING AN ENGINEERING BASIS FOR FLOOD PLAIN REGULATIONS,
W71-04270 04A

TERRACING
INFILTRATION IN CONTOUR TRENCHES IN THE SIERRA NEVADA,
W71-04263 04A

TERTIARY TREATMENT
FLORIDA FIRM USES GAMMA RAYS TO POLISH SEWAGE PLANT EFFLUENT.
W71-03890 05D

A COMPREHENSIVE WATER QUALITY CONTROL PROGRAM FOR THE LAS VEGAS WASH DRAINAGE BASIN.
W71-03902 05D

SANTEE PROJECT CONTINUES TO SHOW THE WAY,
W71-03904 05D

TEST PROCEDURES
SPECTROPHOTOMETRIC DETERMINATION OF CHLORATE ION,
W71-03994 02K

FWPCA METHOD STUDY 1 MINERAL AND PHYSICAL ANALYSES - AN EVALUATION OF FWPCA ANALYTICAL METHODS FOR SURFACE WATERS,
W71-04200 05A

TEXAS
GROUNDWATER RESOURCES OF COLLINGSWORTH COUNTY, TEXAS,
W71-03935 02F

FLOOD PLAIN INFORMATION, KIRBY CREEK, GRAND PRAIRIE, TEXAS.
W71-04143 04A

THALWEG
WILSON V ST REGIS PULP AND PAPER CORP (BOUNDARY LINE BETWEEN PROPERTIES LOCATED ON OPPOSITE SIDES OF STREAM).
W71-04317 06E

THAWING
INVESTIGATION OF THE WATER REGIME OF SOILS IN THE AERATION ZONE, THEIR FREEZING, WATER-PHYSICAL AND FILTRATION PROPERTIES,
W71-03964 02G

THEORY OF IMAGES
GEOHYDROLOGIC BOUNDARY ENVELOPES,
W71-04125 02F

THERMAL POLLUTION
SOME CHARACTERISTICS OF THE THERMAL REGIME OF RIVERS IN THE DANUBE AND DNIESTER BASINS,
W71-03974 02K

THE EVALUATION OF ENVIRONMENTAL ALTERATION BY THERMAL LOADING AND ACID POLLUTION IN THE COOLING RESERVOIR OF A STEAM-ELECTRIC STATION,
W71-04019 05C

ECONOMICS OF THERMAL POLLUTION CONTROL,
W71-04084 05D

THERMAL STRESS
RESPONSES OF NATIVE AND MIGRANT DESERT RESIDENTS TO ARID HEAT,
W71-04301 02I

THERMOCOUPLE PSYCHROMETERS
MEASUREMENT OF WATER POTENTIAL WITH THERMOCOUPLE PSYCHROMETERS CONSTRUCTION AND APPLICATIONS,
W71-04237 02I

WATER POTENTIAL MEASUREMENTS IN TRESS,
W71-04238 02I

THIOCYANATE
SPECTROPHOTOMETRIC DETERMINATION OF THIOCYANATE AND OXALATE,
W71-03928 05A

THORNTHWAITE CLIMATIC CLASSIFICATION
A NEW APPROACH TO THE CLASSIFICATION OF CLIMATE,
W71-04235 02B

THORNTHWAITE METHOD
PROBLEMS OF DETERMINING EVAPOTRANSPIRATION IN THE SEMI-ARID TROPICS ILLUSTRATED WITH REFERENCE TO THE SUDAN,
W71-04236 02D

THORNTHWAITE'S EQUATION
SOME ASPECTS OF DROUGHT CLIMATOLOGY OF THE DRY SUBHUMID ZONES OF SOUTH INDIA,
W71-04298 02B

THORTHWAITE'S FORMULA
SECULAR VARIATION OF ARIDITY IN THE WORLD,
W71-04288 02A

TIDAL CHANNELS
SAND WAVES AND TIDAL CHANNELS IN THE ENTRANCE TO CHESAPEAKE BAY,
W71-03958 02L

TIDAL EFFECTS
DEPOSITIONAL AND DISPERSAL DYNAMICS OF INTERTIDAL SAND BARS,
W71-03948 02J

TIDAL WATERS
SAND WAVES AND TIDAL CHANNELS IN THE ENTRANCE TO CHESAPEAKE BAY,
W71-03958 02L

OYSTERMEN'S DOCK COMPANY V DOWNING (LAND UNDER TIDAL WATERS HELD IN PUBLIC TRUST).
W71-04329 06E

TOPOGRAPHY
RECONSTRUCTION OF SUBGLACIAL RELIEF FROM RADIO ECHO SOUNDING RECORDS,
W71-04112 02C

A CONTRIBUTION TO THE PROBLEM OF SPACING RAINGAUGES IN RUGGED TERRAIN,
W71-04122 07A

TOXICITY
PRETREATMENT OF TOXIC WASTES,
W71-04082 05D

TRACE ELEMENTS
ARSENIC IN POTABLE DESERT GROUNDWATER AN ANALYSIS PROBLEM,
W71-04109 02K

A DIRECT-READING SPECTROCHEMICAL PROCEDURE FOR THE MEASUREMENT OF NINETEEN MINOR ELEMENTS IN NATURAL WATER,
W71-04211 05A

TRACERS
MEASURING STREAM DISCHARGE USING THE DYE-DILUTION METHOD (CHEMICAL GAUGING),
W71-03930 07B

A MECHANICAL DEVICE FOR RELEASING FLUORESCENT TRACERS,
W71-03949 07B

RADIOMETRIC INVESTIGATIONS ON THE BEACH AT THE MOUTH OF THE KURA RIVER,
W71-03962 02J

ISOTOPE HYDROLOGY, 1970.
W71-04133 02A

DISTRIBUTION OF HYDROGEN ISOTOPES IN CANADIAN WATERS,
W71-04134 02A

VARIATION OF THE TRITIUM AND OXYGEN-18 CONTENT IN PRECIPITATION AND SNOWPACK IN A REPRESENTATIVE BASIN IN CZECHOSLOVAKIA,
W71-04135 02A

WATER MOVEMENT IN THE UNSATURATED ZONE OF HIGH AND LOW PERMEABILITY STRATA BY MEASURING NATURAL TRITIUM,
W71-04138 02A

PERCH LAKE EVAPORATION STUDY,
W71-04142 02A

TRACKING TECHNIQUES
MEASURING STREAM DISCHARGE USING THE DYE-DILUTION METHOD (CHEMICAL GAUGING),
W71-03930 07B

RADIOMETRIC INVESTIGATIONS ON THE BEACH AT THE MOUTH OF THE KURA RIVER,
W71-03962 02J

DISTRIBUTION OF HYDROGEN ISOTOPES IN CANADIAN WATERS,
W71-04134 02A

TRANSECTS
PERENNATION IN ASTRAGALUS LENTIGINOSUS AND TRIDENS PULCHELLUS IN RELATION TO RAINFALL,
W71-04299 02I

TRANSPORT
DESIGN OF ACTIVATED CARBON ADSORPTION BEDS,
W71-03897 05D

TRANSPORTATION
FEEDING A DESERT CITY ANTOFAGASTA, CHILE,
W71-04055 03F

TRANSVAAL
SOME PROBLEMS OF A KARST AREA IN THE EASTERN TRANSVAAL, SOUTH AFRICA,
W71-04053 02G

TRAVEL TIME(STREAMFLOW)
WATER DISCHARGE TRAVEL TIME COEFFICIENTS,
W71-03973 02E

TRICHODERMA
MICROBIAL POPULATIONS IN STUBBLE-MULCHED SOIL,
W71-04068 02G

TRICKLING FILTERS
KINETICS OF FIXED FILM BIOLOGICAL REACTORS,
W71-04085 05D

TRITIUM
DISTRIBUTION OF HYDROGEN ISOTOPES IN CANADIAN WATERS,
W71-04134 02A

VARIATION OF THE TRITIUM AND OXYGEN-18 CONTENT IN PRECIPITATION AND SNOWPACK IN A REPRESENTATIVE BASIN IN CZECHOSLOVAKIA,
W71-04135 02A

WATER MOVEMENT IN THE UNSATURATED ZONE OF HIGH AND LOW PERMEABILITY STRATA BY MEASURING NATURAL TRITIUM,
W71-04138 02A

PERCH LAKE EVAPORATION STUDY,
W71-04142 02A

TROPHIC LEVEL
THE ROLE OF AQUATIC VASCULAR PLANTS IN THE EUTROPHICATION OF SELECTED LAKES IN WASTERN MASSACHUSETTS,
W71-03918 05C

TROPICAL CYCLONES
SURVEY OF OBJECTIVE METHODS USED IN HONG KONG FOR PREDICTING TYPHOON MOVEMENT,
W71-04158 02B

LOWER AND MIDDLE IRRAWADDY FLOODS IN RELATION TO HEAVY RAINFALL IN THE HEAD WATER REGIONS OF CHINDWIN AND IRRAWADDY RIVERS,
W71-04165 02E

TRUCKEE RIVER(NEVADA)
FLOOD PLAIN INFORMATION, TRUCKEE RIVER, RENO-SPARKS-TRUCKEE MEADOWS, NEVADA.
W71-04144 04A

TRUST DOCTRINE
OYSTERMEN'S DOCK COMPANY V DOWNING (LAND UNDER TIDAL WATERS HELD IN PUBLIC TRUST).
W71-04329 06E

TUBIFEX TUBIFEX
THE EFFECT OF SOME SOLVENTS ON LOWER WATER ANIMALS AND ON FISHES,
W71-03854 05C

TUCSON
ECONOMIC FEASIBILITY OF SELECTIVE ADJUSTMENT IN USE OF SALVAGEABLE WATERS IN THE TUCSON REGION, ARIZONA,
W71-04269 05D

TUNISIA
IRRIGATION DEVELOPMENT IN TUNISIA,
W71-04232 03F

TURBINE RUNNERS
EXPERIMENTAL INVESTIGATIONS OF HYDRAULIC TURBINES WITH COMBINED RUNNERS,
W71-03998 08C

TYPHOON FORECASTING
SURVEY OF OBJECTIVE METHODS USED IN HONG KONG FOR PREDICTING TYPHOON MOVEMENT,
W71-04158 02B

TYPHOONS
ENVELOPE-FREQUENCY RELATIONS FOR MAXIMUM FLOODS IN MONSOON

AREAS OF THE ECAFE REGION.
W71-04117 02B

SURVEY OF OBJECTIVE METHODS USED IN HONG KONG FOR PREDICTING TYPHOON MOVEMENT,
W71-04158 02B

SOME EXAMPLES OF HEAVY RAINFALL IN JAPAN,
W71-04166 02B

THE PROBLEM OF FLOOD PREDICTION ON THE EAST COAST OF WEST MALAYSIA,
W71-04167 02B

HEAVY RAINFALL IN PAKISTAN AND ITS ASSOCIATED FLOOD,
W71-04168 02B

HEAVY RAINFALL AND ASSOCIATED FLOODS IN WEST PAKISTAN,
W71-04169 02B

THE CIRCULATION PATTERN OVER SINGAPORE AND THE EAST COAST OF WEST MALAYSIA DURING JANUARY AND FEBRUARY 1967 COMPARED WITH THAT OF JANUARY AND FEBRUARY 1968,
W71-04170 02B

ULTIMATE DISPOSAL
MINERAL RECOVERY FROM CONCENTRATED BRINES,
W71-04223 02K

ULTRAFILTRATION
SOLIDS SEPARATION BY ULTRAFILTRATION FOR CONCENTRATED ACTIVATED SLUDGE,
W71-04087 05D

UNDERGROUND STORAGE
EFFECT OF DISPERSION, GRAVITATIONAL SEGREGATION, AND FORMATION STRATIFICATION ON THE RECOVERY OF FRESHWATER STORED IN SALINE AQUIFERS,
W71-03870 02F

UNDERGROUND WATER STORAGE
EFFECT OF DISPERSION, GRAVITATIONAL SEGREGATION, AND FORMATION STRATIFICATION ON THE RECOVERY OF FRESHWATER STORED IN SALINE AQUIFERS,
W71-03870 02F

UNIT HYDROGRAPHS
ANALYSIS OF THE RELATION BETWEEN PRECIPITATION AND FLOOD FLOW WITH THE AID OF A TRIPLE TRANSFORMATION BASED ON THE UNIT HYDROGRAPH METHOD (FRENCH),
W71-03980 02A

CONSTRUCTION OF THE UNIT HYDROGRAPH BY THE METHOD OF HYDROLOGIC ANALOGY (FRENCH),
W71-03981 02E

UNITED STATES
WATER SUPPLY OUTLOOK FOR THE WESTERN UNITED STATES, 1970-71 WATER YEAR.
W71-03927 02B

UNSATURATED FLOW
SATURATION-UNSATURATION TRANSITION IN INFILTRATION TO A NON-UNIFORM SOIL PROFILE,
W71-04066 02G

UNSTEADY FLOW
GEOHYDROLOGIC BOUNDARY ENVELOPES,
W71-04125 02F

CALCULATION OF FLOOD WAVES FOR A LARGE RIVER SYSTEM,
W71-04176 02E

URANIUM
STUDY OF WATER POLLUTION PROBLEMS WHICH AFFECT FISH AND OTHER AQUATIC FORMS,
W71-03852 05C

URBAN DRAINAGE
1939 RUNOFF INSTRUCTIONS FOR DESIGN OF STORM DRAINS, OFFICE STANDARD NO. 71.
W71-03906 08A

URBAN HYDROLOGY
QUALITY OF RUNOFF FROM DIVERSIFIED URBAN WATERSHEDS,
W71-03929 05A

URBANIZATION
A COMPREHENSIVE WATER QUALITY CONTROL PROGRAM FOR THE LAS VEGAS WASH DRAINAGE BASIN. PHASE I.
W71-03901 05D

A COMPREHENSIVE WATER QUALITY CONTROL PROGRAM FOR THE LAS VEGAS WASH DRAINAGE BASIN.
W71-03902 05D

A MULTI-PHASIC COMPONENT STUDY TO PREDICT STORM WATER POLLUTION FROM URBAN AREAS,
W71-03917 05C

TECHNOLOGY FOR SEDIMENT CONTROL IN URBAN AREAS,
W71-04748 04D

USSR
MAP OF TOTAL STREAMFLOW FROM THE TERRITORY OF THE SOVIET UNION,
W71-03960 02E

HYDRAULIC RESISTANCE AND FORMULA FOR COMPUTING THE AVERAGE FLOW VELOCITY OF MOUNTAIN RIVERS,
W71-03961 02E

INVESTIGATION OF THE WATER REGIME OF SOILS IN THE AERATION ZONE, THEIR FREEZING, WATER-PHYSICAL AND FILTRATION PROPERTIES,
W71-03964 02G

INFLUENCE OF THE BANKS AND FLOOD PLAIN ON CHANNEL CONVEYANCE,
W71-03968 02E

PATTERN OF VARIATION OF THE LENGTH OF FREELY MEANDERING RIVERS,
W71-03969 02J

SOME FEATURES OF THE MECHANICS OF GLACIER MOVEMENT,
W71-03972 02C

SOME CHARACTERISTICS OF THE THERMAL REGIME OF RIVERS IN THE DANUBE AND DNIESTER BASINS,
W71-03974 02K

COMPUTATION OF FLOW IN GLACIER-FED RIVERS,
W71-03975 02E

COMPUTATION OF MAXIMUM STORM DISCHARGE OF MOUNTAIN RIVERS,
W71-03982 02A

GEOGRAPHICAL ASPECTS OF THE USE OF WATER RESOURCES IN THE SOVIET ECONOMY,
W71-04052 03F

PROGRESS IN WATER DESALINATION TECHNOLOGY,
W71-04229 03A

UTAH
WATER-QUALITY DATA FOR THE FLAMING GORGE RESERVOIR AREA, UTAH AND WYOMING,
W71-03936 07C

UTAH REGIONAL FLOOD
FLOOD PLAIN INFORMATION, BURCH CREEK, OGDEN, UTAH.
W71-04145 04A

UTILITIES
STRUCTURE OF PUBLICLY-OWNED WATER UTILITIES,
W71-04281 06E

VALDAI HYDROLOGIC LABORATORY(USSR)
INVESTIGATION OF THE WATER REGIME OF SOILS IN THE AERATION ZONE, THEIR FREEZING, WATER-PHYSICAL AND FILTRATION PROPERTIES,
W71-03964 02G

VEGETATION
POTENTIAL EVAPOTRANSPIRATION AND THE WATER BALANCE IN WEST AFRICA AN ALTERNATIVE METHOD OF PENMAN,
W71-04063 02D

PROBLEMS OF DETERMINING EVAPOTRANSPIRATION IN THE SEMI-ARID TROPICS ILLUSTRATED WITH REFERENCE TO THE SUDAN,
W71-04236 02D

VEGETATION EFFECTS
CLIMATE AND OVERGRAZING ON THE SHONTO PLATEAU, ARIZONA,
W71-04064 03F

THE EFFECT OF VEGETATION CONVERSION AND FLOOD DISCHARGE ON STREAM CHANNEL GEOMETRY THE CASE OF SOUTHERN CALIFORNIA WATERSHEDS,
W71-04230 04D

INCREASES IN WATER YIELD FOLLOWING CLEAR-CUT LOGGING IN THE PACIFIC NORTHWEST,
W71-04240 03B

INFILTRATION AND SOIL EROSION AS INFLUENCED BY VEGETATION AND SOIL IN NORTHERN UTAH,
W71-04260 02J

INFILTRATION AND SOIL EROSION ON COOLWATER RIDGE, IDAHO,
W71-04261 02J

VEGETATION ESTABLISHMENT
FOURWING SALTBUSH CAN BE FIELD PLANTED SUCCESSFULLY,
W71-04247 04A

VEGETATION REGROWTH
THE SAM SIMON WATERSHED SHRUB CONTROL,
W71-04058 03F

VEGETATION ZONES
CLIMATE AND OVERGRAZING ON THE SHONTO PLATEAU, ARIZONA,
W71-04064 03F

VELOCITY
WATER DISCHARGE TRAVEL TIME COEFFICIENTS,
W71-03973 02E

VERMICULITIES
CHEMICAL EXFOLIATED VERMICULITE FOR REMOVAL OF PHOSPHATE FROM WASTE WATERS,
W71-04107 05D

VERMONT
CORCORAN V VILLAGE OF BENNINGTON (RIGHT TO WATER AND SEWER SERVICE PERMITS).
W71-04071 06E

SCANLAN V HOPKINS (LEGAL CONSEQUENCES OF AGREEMENT BY GRANTOR TO CONSTRUCT CULVERT OVER NATURAL WATERCOURSE).
W71-04314 06E

VERTICAL FLOW
SATURATION-UNSATURATION TRANSITION IN INFILTRATION TO A NON-UNIFORM SOIL PROFILE,
W71-04066 02G

VIBRATIONS
DETERMINING THE CRITICAL SPEEDS OF HYDRAULIC UNIT SHAFTS,
W71-03996 08C

VIRGINIA
A WINTER LIMNOLOGICAL STUDY OF LAKE WILCOX A FRESHWATER IMPOUNDMENT,
W71-03957 02H

A CASE STUDY OF MICROORGANIC CONTAMINANTS IN RIVER WATER,
W71-04119 05A

STATE WATER CONTROL LAW.
W71-04335 06E

CHESAPEAKE BAY IN LEGAL PERSPECTIVE,
W71-04337 06E

GARDEN CLUB OF VIRGINIA V VIRGINIA PUBLIC SERVICE CO (JURISDICTION OF CORPORATION COMMISSION TO GRANT PERMIT FOR DAM ON NON-NAVIGABLE RIVER).
W71-04343 06E

VIRUSES
ELEVATION AND TEMPERATURE EFFECTS ON SEVERITY OF MAIZE DWARF MOSAIC VIRUS IN SORGHUM,
W71-04060 03F

VOLCANIC ASH SOILS(HAWAII)
SOLUBILITY AND AVAILABILITY OF SORBED SULFATE IN HAWAIIAN SOILS,
W71-03941 02G

WARMTH INDEX
A NEW APPROACH TO THE CLASSIFICATION OF CLIMATE,
W71-04235 02B

WASHINGTON
AVAILABILITY OF GROUNDWATER IN WESTERN COWLITZ COUNTY, WASHINGTON,
W71-03934 02F

WASTE DILUTION
COAL CREEK DRAINAGE AND LEVEE DIST V SANITARY DIST OF CHICAGO (DRAINAGE DISTRICT'S LIABILITY FOR DISCHARGE OF EXCESSIVE WATER INTO RIVER).
W71-04198 06E

WASTE STABILIZATION
DESIGN CONSTRUCTION AND MAINTENANCE OF WASTE STABILIZATION LAGOONS,
W71-03896 05D

WASTE TREATMENT
MULTI-STAGE BIOLOGICAL PROCESSES FOR WASTE TREATMENT,
W71-03894 05D

PRETREATMENT OF TOXIC WASTES,
W71-04082 05D

WASTE WATER TREATMENT
A REVIEW OF THE 1969 LITERATURE ON WASTE WATER AND WATER POLLUTION CONTROL, ADMINISTRATION SYSTEMS ANALYSIS,
W71-03879 05G

A COMPREHENSIVE WATER QUALITY CONTROL PROGRAM FOR THE LAS VEGAS WASH DRAINAGE BASIN. PHASE I.
W71-03901 05D

A COMPREHENSIVE WATER QUALITY CONTROL PROGRAM FOR THE LAS VEGAS WASH DRAINAGE BASIN.
W71-03902 05D

SANTEE PROJECT CONTINUES TO SHOW THE WAY,
W71-03904 05D

ENGINEERING EVALUATION OF FACTORS AFFECTING QUALITY OF WATER SOURCES AVAILABLE FOR SALINE WATER CONVERSION PLANTS,
W71-03916 03A

HIGH-RATE BIOFILTRATION PAST AND FUTURE,
W71-04076 05D

WASTE WATER TREATMENT FACILITIES AT BURNS HARBOR,
W71-04080 05D

BIOLOGICAL CHEMICAL COMBINATION DRAMATICALLY CUTS TREATMENT,
W71-04086 05D

SOLIDS SEPARATION BY ULTRAFILTRATION FOR CONCENTRATED ACTIVATED SLUDGE,
W71-04087 05D

CHEMICAL EXFOLIATED VERMICULITE FOR REMOVAL OF PHOSPHATE FROM WASTE WATERS,
W71-04107 05D

MEMBRANE MATERIALS FOR WASTE WATER RECLAMATION BY REVERSE OSMOSIS,
W71-04185 05D

ENGINEERING FEASIBILITY DEMONSTRATION STUDY FOR MUSKEGON COUNTY, MICHIGAN, WASTE WATER TREATMENT-IRRIGATION SYSTEM.
W71-04186 05D

TREATMENT OF ACID MINE DRAINAGE BY FOAM SEPARATION,
W71-04188 05D

WASTE WATER TREATMENT IRON COMPOUNDS
NEUTRALIZATION OF HIGH FERRIC IRON ACID MINE DRAINAGE,
W71-04189 05D

WASTE WATER(POLLUTION)
PESTICIDES IN SURFACE WATERS OF THE UNITED STATES A FIVE-YEAR SUMMARY 1964-1968,
W71-04201 05A

FWPCA METHODS FOR CHEMICAL ANALSIS OF WATER AND WASTES.
W71-04202 05A

WATER ALLOCATION(POLICY)
OPTIMAL ALLOCATION OF STOCHASTIC WATER SUPPLY,
W71-04028 03B

THE POLITICS OF WATER,
W71-04091 06E

THE LAND AND WATER CONSERVATION FUND ACT DEVELOPMENT AND IMPACT,
W71-04097 06E

WATER AND CULTURE NEW DECISION RULES FOR OLD INSTITUTIONS,
W71-04296 06E

FEDERAL WATER-POWER LEGISLATION,
W71-04307 06E

WATER ANALYSIS
SPECTROPHOTOMETRIC DETERMINATION OF THIOCYANATE AND OXALATE,
W71-03928 05A

THE BACKGROUND CONCENTRATIONS OF COPPER, LEAD, AND ZINC IN STREAMS OF THE 'NEW LEAD BELT', MISSOURI,
W71-04182 05A

FWPCA METHOD STUDY 1 MINERAL AND PHYSICAL ANALYSES - AN EVALUATION OF FWPCA ANALYTICAL METHODS FOR SURFACE WATERS,
W71-04200 05A

METHOD SELECTION STUDY 1 A COMPARISON OF THREE MODIFICATIONS OF THE SINGLE REAGENT METHOD FOR SOLUBLE ORTHOPHOSPHATE,
W71-04204 05A

WATER BALANCE
DERIVATION OF A GENERAL FLOOD WAVE HYDROGRAPH FROM A CONTINUOUS WATERSHED WATER BALANCE,
W71-03989 02E

POTENTIAL EVAPOTRANSPIRATION AND THE WATER BALANCE IN WEST AFRICA AN ALTERNATIVE METHOD OF PENMAN,
W71-04063 02D

QUANTITATIVE ASPECTS OF THE STUDY OF WATER BALANCES IN LAKES USING THE DEUTERIUM AND OXYGEN-18 CONCENTRATIONS IN THE WATER, (FRENCH),
W71-04139 02A

ENVIRONMENTAL ISOTOPE BALANCE OF LAKE TIBERIAS,
W71-04140 02A

STABLE ISOTOPES IN STUDY OF WATER BALANCE OF LAKE NEUSIEDL, AUSTRIA INVESTIGATION OF THE RELIABILITY OF THE STABLE ISOTOPE METHOD,
W71-04141 02A

PERCH LAKE EVAPORATION STUDY,
W71-04142 02A

A NEW APPROACH TO THE CLASSIFICATION OF CLIMATE,
W71-04235 02B

PROBLEMS OF DETERMINING EVAPOTRANSPIRATION IN THE SEMI-ARID TROPICS ILLUSTRATED WITH REFERENCE TO THE SUDAN,
W71-04236 02D

SOME ASPECTS OF DROUGHT CLIMATOLOGY OF THE DRY SUBHUMID ZONES OF SOUTH INDIA,
W71-04298 02B

WATER CHEMISTRY
THE INCIDENCE AND FORMATION OF MINE DRAINAGE POLLUTION - APPENDIX C TO 'REPORT FOR DEVELOPMENT OF WATER RESOURCES OF APPALACHIA'.
W71-03872 05B

STREAM POLLUTION BY COAL MINE DRAINAGE IN APPALACHIA.
W71-03873 05B

MICROBIAL CARBONATE AND PHOSPHATE PRECIPITATES FROM SEA WATER CULTURES,
W71-03950 02K

SUBMARINE VOLCANISM AS A SOURCE FOR IRON,
W71-03955 02K

CHEMICAL EXCHANGE BETWEEN SEA WATER AND DEEP OCEAN BASALTS,
W71-03956 02K

THEORETICAL MEAN ACTIVITY COEFFICIENTS OF STRONG ELECTROLYTES IN AQUEOUS SOLUTIONS FROM 0 TO 100 DEG C,
W71-04183 01B

WATER CIRCULATION
THE PERIODIC CYCLE OF PARTICULATE MATTER IN A SHALLOW, TEMPERATE ESTUARY,

W71-03943 02L

WATER CONSERVATION
GEOGRAPHICAL ASPECTS OF THE USE OF WATER RESOURCES IN THE SOVIET ECONOMY,
W71-04052 03F

THE IMPACT OF AGRICULTURAL CHANGE ON A LOCAL ECONOMY IN THE GREAT PLAINS,
W71-04289 03F

IRRIGATION AS A FARM GROWTH STRATEGY,
W71-04290 03F

THE PUMPED WELL,
W71-04292 04B

USING COMPUTERS TO HELP EVALUATE FLOOD PROTECTION MEASURES,
W71-04293 07C

WATER CONTRACTS
KIRK V PROVIDENCE MILL CO (SURPLUS WATER RIGHTS SUBJECT TO STATE'S RIGHT TO ABANDON AND DRAIN CANAL).
W71-04344 06E

WATER CONVEYANCE
WATER, A PROGRESS REPORT.
W71-03905 08A

WATER COSTS
PROGRESS IN WATER DESALINATION TECHNOLOGY,
W71-04229 03A

DRY LANDS AND A HUNGRY WORLD,
W71-04291 06B

WATER DEMAND
WASTE WATER TREATMENT FACILITIES AT BURNS HARBOR,
W71-04080 05D

WATER USE IN TENNESSEE, PART D - SUMMARY,
W71-04324 06D

WATER DISTRICTS
RECOMMENDATIONS CONCERNING PROPOSED LEGISLATION TO AUTHORIZE WATER MANAGEMENT DISTRICTS IN FLORIDA.
W71-03878 06E

WATER AND CULTURE NEW DECISION RULES FOR OLD INSTITUTIONS,
W71-04296 06E

WATER EQUIVALENT
SOME PROBLEMS OF DETERMINING THE WATER EQUIVALENT OF THE SNOW COVER,
W71-04173 02C

WATER LAW
WATER RIGHTS LAW AND MANAGEMENT IN WEST VIRGINIA -- FUTURE NEEDS AND ALTERNATIVES,
W71-03880 06E

RIGHTS TO SURFACE AND SUBSURFACE WATER IN MASSACHUSETTS.
W71-03882 06E

PRINCIPLES OF WATER RIGHTS LAW IN OHIO,
W71-04022 06E

PUBLIC WATER POLICY IN TENNESSEE.
W71-04308 06E

WATER-USE LAW IN MISSOURI,
W71-04339 06E

WATER LEVEL FLUCTUATIONS
FINITE AQUIFERS CHARACTERISTIC RESPONSES AND APPLICATIONS,
W71-04126 02F

WATER LEVELS
REMOTE GROUNDWATER LEVEL METER FOR BOG STATIONS,
W71-03966 07B

WATER LOSS
INFLUENCE OF LOW RATES OF WATER APPLICATION BY SPRINKLERS ON THE MICROCLIMATE,
W71-03925 02D

MEASUREMENT OF WATER POTENTIAL WITH THERMOCOUPLE PSYCHROMETERS CONSTRUCTION AND APPLICATIONS,
W71-04237 02I

WATER POTENTIAL MEASUREMENTS IN TRESS,
W71-04238 02I

LEAF SAMPLER FOR RELATIVE WATER CONTENT MEASUREMENTS DESIGN AND APPLICATION,
W71-04239 02I

ASPEN SPROUT PRODUCTION AND WATER USE,
W71-04241 02I

SOIL MOISTURE DEPLETION AND ESTIMATED EVAPOTRANSPIRATION ON UTAH MOUNTAIN WATERSHED,
W71-04242 02D

RESPONSES OF NATIVE AND MIGRANT DESERT RESIDENTS TO ARID HEAT,
W71-04301 02I

INFLUENCE OF MANAGEMENT AND ENVIRONMENTAL FACTORS ON EXTENT OF SOIL WATER DEPLETION BY SPRING WHEAT,
W71-04303 03F

WATER MANAGEMENT(APPLIED)
RECOMMENDATIONS CONCERNING PROPOSED LEGISLATION TO AUTHORIZE WATER MANAGEMENT DISTRICTS IN FLORIDA.
W71-03878 06E

SYSTEM OPTIMIZATION FOR RIVER BASIN WATER QUALITY MANAGEMENT,
W71-03881 05G

OPTIMUM FIRE POWER OUTPUT FROM A TWO RESERVOIR SYSTEM BY INCREMENTAL DYNAMIC PROGRAMMING,
W71-04111 04A

THE IMPACT OF AGRICULTURAL CHANGE ON A LOCAL ECONOMY IN THE GREAT PLAINS,
W71-04289 03F

THE PUMPED WELL,
W71-04292 04B

INFLUENCE OF MANAGEMENT AND ENVIRONMENTAL FACTORS ON EXTENT OF SOIL WATER DEPLETION BY SPRING WHEAT,
W71-04303 03F

WATER MEASUREMENT
WATER MEASUREMENT PROCEDURES - IRRIGATION OPERATORS' WORKSHOP.
W71-04007 08B

MEASUREMENT OF WATER POTENTIAL WITH THERMOCOUPLE PSYCHROMETERS CONSTRUCTION AND APPLICATIONS,
W71-04237 02I

WATER POTENTIAL MEASUREMENTS IN TRESS,
W71-04238 02I

LEAF SAMPLER FOR RELATIVE WATER CONTENT MEASUREMENTS DESIGN AND APPLICATION,
W71-04239 02I

WATER PERMITS
CORCORAN V VILLAGE OF BENNINGTON (RIGHT TO WATER AND SEWER SERVICE PERMITS).
W71-04071 06E

PUBLIC WORKS AUTHORIZATIONS, 1968 - RIVERS AND HARBORS - FLOOD CONTROL AND MULTIPLE PURPOSE PROJECTS - PART I.
W71-04254 06E

WATER POLICY
PUBLIC WATER POLICY IN TENNESSEE.
W71-04308 06E

WATER POLLUTION
ARSENIC IN POTABLE DESERT GROUNDWATER AN ANALYSIS PROBLEM,
W71-04109 02K

ARTIFICIAL SUBSTRATE SAMPLING, MACROINVERTEBRATES IN A POLLUTED REACH OF THE KLAMATH RIVER, OREGON,
W71-04191 05A

CITY OF SALEM V HARDING (CITY'S NEGLIGENCE IN CAUSING ILLNESS BY CONTAMINATION OF WATER SUPPLY).
W71-04278 06E

OFFSHORE OIL SPILLS AN EVALUATION OF RECENT UNITED STATES RESPONSES,
W71-04305 06E

PEOPLE V PORT OF NEW YORK AUTHORITY (REMEDY FOR POLLUTION OF STATE PROPERTY).
W71-04311 06E

CITYCO REALTY CO V MAYOR, COUNSELOR, AND ALDERMAN OF ANNAPOLIS (RIGHT OF CITY TO DISCHARGE SEWAGE INTO STREAM).
W71-04319 06E

WATER POLLUTION CONTROL
THE INCIDENCE AND FORMATION OF MINE DRAINAGE POLLUTION - APPENDIX C TO 'REPORT FOR DEVELOPMENT OF WATER RESOURCES OF APPALACHIA'.
W71-03872 05B

STREAM POLLUTION BY COAL MINE DRAINAGE IN APPALACHIA.
W71-03873 05B

A REVIEW OF CURRENT RESEARCH ON COAL MINE DRAINAGE IN APPALACHIA,
W71-03874 05B

FACTORS THAT AFFECT THE FORMATION OF COAL MINE DRAINAGE POLLUTION IN APPALACHIA,
W71-03875 05B

THE OXIDATION OF PYRITE ASSOCIATED WITH COAL MINES,
W71-03876 05B

SURVEY OF COSTS ON METHODS FOR CONTROL OF ACID MINE DRAINAGE POLLUTION,
W71-03877 05B

A REVIEW OF THE 1969 LITERATURE ON WASTE WATER AND WATER POLLUTION CONTROL, ADMINISTRATION SYSTEMS ANALYSIS,
W71-03879 05G

MATHEMATICAL MODELS AS AN AID IN THE SOLUTION OF WATER POLLUTION CONTROL PROBLEMS,
W71-03884 05G

A COMPREHENSIVE WATER QUALITY CONTROL PROGRAM FOR THE LAS

VEGAS WASH DRAINAGE BASIN. PHASE I.
W71-03901 05D

A COMPREHENSIVE WATER QUALITY CONTROL PROGRAM FOR THE LAS VEGAS WASH DRAINAGE BASIN.
W71-03902 05D

AN ECONOMIC EVALUATION OF THE WATER QUALITY ASPECTS OF CONTRA COSTA COUNTY'S OFFSHORE WATER SUPPLY.
W71-03909 06B

THE ECONOMIC IMPACT OF ALTERNATIVE WATER CONDITIONS, A REPORT TO THE CONTRA COSTA COUNTY WATER AGENCY.
W71-03910 06B

A MULTI-PHASIC COMPONENT STUDY TO PREDICT STORM WATER POLLUTION FROM URBAN AREAS,
W71-03917 05C

FEDERAL ENFORCEMENT UNDER THE REFUSE ACT OF 1899,
W71-04102 06E

POLLUTION PROBLEMS, RESOURCE POLICY AND THE SCIENTIST,
W71-04280 06B

PEOPLE V PORT OF NEW YORK AUTHORITY (REMEDY FOR POLLUTION OF STATE PROPERTY).
W71-04311 06E

STATE WATER CONTROL LAW.
W71-04335 06E

OUTLINE -- ENFORCEMENT OF 1899 REFUSE ACT THROUGH CITIZEN ACTION.
W71-04336 06E

WATER POLLUTION EFFECTS
STUDY OF WATER POLLUTION PROBLEMS WHICH AFFECT FISH AND OTHER AQUATIC FORMS,
W71-03852 05C

THE EFFECT OF SOME SOLVENTS ON LOWER WATER ANIMALS AND ON FISHES,
W71-03854 05C

EFFECTS OF WASTE DISPOSAL INTO MARINE WATERS - A SURVEY OF STUDIES CARRIED OUT IN THE LAST TEN YEARS,
W71-04114 05C

COST OF PATUXENT RIVER QUALITY MONITORING,
W71-04115 05A

STUDY OF MOLYBDENUM IN PUBLIC WATER SUPPLY,
W71-04120 05A

WATER POLLUTION SOURCES
THE INCIDENCE AND FORMATION OF MINE DRAINAGE POLLUTION - APPENDIX C TO 'REPORT FOR DEVELOPMENT OF WATER RESOURCES OF APPALACHIA'.
W71-03872 05B

STREAM POLLUTION BY COAL MINE DRAINAGE IN APPALACHIA.
W71-03873 05B

A REVIEW OF CURRENT RESEARCH ON COAL MINE DRAINAGE IN APPALACHIA,
W71-03874 05B

FACTORS THAT AFFECT THE FORMATION OF COAL MINE DRAINAGE POLLUTION IN APPALACHIA,
W71-03875 05B

THE OXIDATION OF PYRITE ASSOCIATED WITH COAL MINES,
W71-03876 05B

ECORSE RIVER WATER QUALITY STUDY, MAY-JULY, 1969.
W71-03907 05B

MINE ACID DRAINAGE AND ASSOCIATED FLOW FLUCTUATIONS,
W71-03938 05B

EFFECT OF SOLID WASTE DISPOSAL ON GROUNDWATER QUALITY,
W71-04116 05C

STUDY OF MOLYBDENUM IN PUBLIC WATER SUPPLY,
W71-04120 05A

MOVEMENT OF AGRICULTURAL POLLUTANTS WITH GROUNDWATER,
W71-04121 05B

THE BACKGROUND CONCENTRATIONS OF COPPER, LEAD, AND ZINC IN STREAMS OF THE 'NEW LEAD BELT', MISSOURI,
W71-04182 05A

WATER POTENTIAL
WATER POTENTIAL MEASUREMENTS IN TRESS,
W71-04238 02I

WATER PROPERTIES
THEORETICAL MEAN ACTIVITY COEFFICIENTS OF STRONG ELECTROLYTES IN AQUEOUS SOLUTIONS FROM 0 TO 100 DEG C,
W71-04183 01B

WATER PURIFICATION
DESIGN OF ACTIVATED CARBON ADSORPTION BEDS,
W71-03897 05D

WATER QUALITY
INSTITUTIONAL DESIGN FOR WATER QUALITY MANAGEMENT THE IMPLICATIONS OF A SYSTEMS APPROACH FOR LEGAL AND ADMINISTRATIVE ARRANGEMENTS,
W71-03867 06E

QUALITY OF RUNOFF FROM DIVERSIFIED URBAN WATERSHEDS,
W71-03929 05A

WATER-QUALITY DATA FOR THE FLAMING GORGE RESERVOIR AREA, UTAH AND WYOMING,
W71-03936 07C

QUALITY OF SURFACE WATERS OF THE UNITED STATES, 1965 PARTS 7 AND 8. LOWER MISSISSIPPI RIVER BASIN AND WESTERN GULF OF MEXICO BASINS.
W71-04048 02K

ACTIVITIES OF THE FEDERAL WATER POLLUTION CONTROL ADMINISTRATION--WATER QUALITY STANDARDS.
W71-04096 06E

COST OF PATUXENT RIVER QUALITY MONITORING,
W71-04115 05A

A CASE STUDY OF MICROORGANIC CONTAMINANTS IN RIVER WATER,
W71-04119 05A

CATALOG OF INFORMATION ON WATER DATA, EDITION 1970 - INDEX TO WATER QUALITY SECTION.
W71-04150 07C

THE BACKGROUND CONCENTRATIONS OF COPPER, LEAD, AND ZINC IN STREAMS OF THE 'NEW LEAD BELT', MISSOURI,
W71-04182 05A

ARTIFICIAL SUBSTRATE SAMPLING, MACROINVERTEBRATES IN A POLLUTED REACH OF THE KLAMATH RIVER, OREGON,
W71-04191 05A

A NEW FRESHWATER CENTRIC DIATOM MICROSIPHONA POTAMOS GEN. ET SP. NOV.,
W71-04193 05C

USE OF A FLOATING PERIPHYTON SAMPLER FOR WATER POLLUTION SURVEILLANCE,
W71-04194 05B

PERIPHYTON BIOMASS-CHLOROPHYLL RATIO AS AN INDEX OF WATER QUALITY,
W71-04206 05A

LIMNOLOGICAL FEATURES OF A NORTHERN BROWN-WATER STREAM, WITH SPECIAL REFERENCES TO THE LIFE HISTORIES OF THE AQUATIC INSECTS,
W71-04215 05C

WATERSHED MANAGEMENT IN THE UNITED STATES CONCEPTS AND PRINCIPLES,
W71-04253 03B

WATER QUALITY ACT
ACTIVITIES OF THE FEDERAL WATER POLLUTION CONTROL ADMINISTRATION--WATER QUALITY STANDARDS.
W71-04096 06E

WATER QUALITY CONTROL
SYSTEM OPTIMIZATION FOR RIVER BASIN WATER QUALITY MANAGEMENT,
W71-03881 05G

A COMPREHENSIVE WATER QUALITY CONTROL PROGRAM FOR THE LAS VEGAS WASH DRAINAGE BASIN. PHASE I.
W71-03901 05D

A COMPREHENSIVE WATER QUALITY CONTROL PROGRAM FOR THE LAS VEGAS WASH DRAINAGE BASIN.
W71-03902 05D

AN ECONOMIC EVALUATION OF THE WATER QUALITY ASPECTS OF CONTRA COSTA COUNTY'S OFFSHORE WATER SUPPLY.
W71-03909 06B

THE ECONOMIC IMPACT OF ALTERNATIVE WATER CONDITIONS, A REPORT TO THE CONTRA COSTA COUNTY WATER AGENCY.
W71-03910 06B

A MULTI-PHASIC COMPONENT STUDY TO PREDICT STORM WATER POLLUTION FROM URBAN AREAS,
W71-03917 05C

APPLICATION OF INDUSTRIAL DYNAMICS CONCEPTS TO DECISION MAKING IN ENVIRONMENTAL MANAGEMENT,
W71-04025 05G

MATHEMATICAL PROGRAMMING APPLICATIONS TO WATER QUALITY PLANNING FOR THE BOSTON HARBOR REGION,
W71-04036 05G

A WATER-QUALITY SIMULATION MODEL FOR WELL-MIXED ESTUARIES AND COASTAL SEAS VOLUME I, PRINCIPLES OF COMPUTATION,
W71-04038 06A

STREAM QUALITY MODELING BY QUASILINEARIZATION,
W71-04045 05F

WATER QUALITY CONTROL A MODERN APPROACH TO STATE REGULATION,
W71-04101 06E

STATE WATER CONTROL LAW.
W71-04335 06E

WATER QUALITY MANAGEMENT
INSTITUTIONAL DESIGN FOR WATER QUALITY MANAGEMENT THE

IMPLICATIONS OF A SYSTEMS APPROACH FOR LEGAL AND ADMINISTRATIVE ARRANGEMENTS,
W71-03867 06E

WATER RATES
CITY OF LEXINGTON V LEXINGTON WATER CO (WATER COMPANY'S PROFIT IN LAND SALE NOT RELEVANT IN FIXING RATES).
W71-04316 06E

WATER RECLAMATION
ENGINEERING EVALUATION OF FACTORS AFFECTING QUALITY OF WATER SOURCES AVAILABLE FOR SALINE WATER CONVERSION PLANTS,
W71-03916 03A

WATER REQUIREMENTS
WASTE WATER TREATMENT FACILITIES AT BURNS HARBOR,
W71-04080 05D

WATER RESOURCES
WATER RESOURCES PLANNING IN THE URBAN-METROPOLITAN CONTEXT,
W71-03861 06B

WATER RESOURCES SYSTEMS ENGINEERING,
W71-03885 06A

AVAILABILITY OF GROUNDWATER IN WESTERN COWLITZ COUNTY, WASHINGTON,
W71-03934 02F

GEOLOGY AND GROUNDWATER RESOURCES OF ALLEN COUNTY, KANSAS,
W71-03937 02F

KENTUCKY WATER RESOURCES 1965 (SUMMARY OF INFORMATION INVOLVING KENTUCKY'S WATER RESOURCES).
W71-04021 06E

OPTIMIZATION OF WATER RESOURCES SYSTEMS BY THE GRADIENT PROJECTION METHOD,
W71-04047 06A

COMPUTER AIDS GROUNDWATER RESOURCES RESEARCH PROJECT,
W71-04057 02F

THE WORLD OF WATER,
W71-04118 02A

WATER RESOURCES DEVELOPMENT
CONDITIONS OF LEGAL AND POLITICAL FEASIBILITY,
W71-03866 06E

NEW HORIZONS IN WATER RESOURCES ADMINISTRATION,
W71-03887 06E

A COMPREHENSIVE WATER QUALITY CONTROL PROGRAM FOR THE LAS VEGAS WASH DRAINAGE BASIN. PHASE I.
W71-03901 05D

WATER, A PROGRESS REPORT.
W71-03905 08A

BENEFIT-COST ANALYSIS AND MULTIPLE OBJECTIVES CURRENT ISSUES IN WATER RESOURCES PLANNING,
W71-04023 06C

TOOLS FOR WATER-RESOURCE STUDY,
W71-04027 06A

OPTIMIZATION OF WATER RESOURCE SYSTEMS INCORPORATING EARTHQUAKE RISK PROGRESS REPORT NO 1,
W71-04041 06A

MODELING AND OPTIMIZATION OF WATER RESOURCES SYSTEMS - PHASE I,
W71-04043 06A

NATURE'S LAW AND MAN'S ETHIC,
W71-04069 04C

THE DELAWARE RIVER BASIN COMPACT--AN ALTERNATIVE FOR IMPLEMENTING WATER RESOURCES MANAGEMENT (ORGANIZATION, OPERATION, AND RESULTS OF THE BASIN COMPACT),
W71-04089 06E

THE PROPOSED POTOMAC RIVER BASIN COMPACT,
W71-04090 06E

THE POLITICS OF WATER,
W71-04091 06E

DELAWARE RIVER BASIN COMPACT.
W71-04093 06E

INSURING MAXIMUM BENEFICIAL USE OF WATER THROUGH LEGISLATION,
W71-04099 06E

WATER QUALITY CONTROL A MODERN APPROACH TO STATE REGULATION,
W71-04101 06E

WATERSHED PROJECTS.
W71-04104 06E

FEDERAL WATER RESOURCES RESEARCH ACTIVITIES.
W71-04105 06E

POLLUTION PROBLEMS, RESOURCE POLICY AND THE SCIENTIST,
W71-04280 06B

THE INSTITUTIONAL FRAMEWORK FOR WATER MANAGEMENT IN ENGLAND AND WALES,
W71-04282 06E

IRRIGATION AS A FARM GROWTH STRATEGY,
W71-04290 03F

WATER RESOURCES DEVELOPMENT PLANNING
THE LEGAL SYSTEM STRUCTURE OR CONSTRAINT FOR SYSTEMS ANALYSIS DECISION-MAKING,
W71-03865 06E

WATER REUSE
FLORIDA FIRM USES GAMMA RAYS TO POLISH SEWAGE PLANT EFFLUENT.
W71-03890 05D

WASTE CONTROL HIGHLIGHTS PLANT DESIGN.
W71-03899 05D

SANTEE PROJECT CONTINUES TO SHOW THE WAY,
W71-03904 05D

DEVELOPMENT OF ECONOMICAL METHODS OF BORON REMOVAL FROM IRRIGATION RETURN WATERS,
W71-03914 05D

MEMBRANE MATERIALS FOR WASTE WATER RECLAMATION BY REVERSE OSMOSIS,
W71-04185 05D

ENGINEERING FEASIBILITY DEMONSTRATION STUDY FOR MUSKEGON COUNTY, MICHIGAN, WASTE WATER TREATMENT-IRRIGATION SYSTEM.
W71-04186 05D

ECONOMIC FEASIBILITY OF SELECTIVE ADJUSTMENT IN USE OF SALVAGEABLE WATERS IN THE TUCSON REGION, ARIZONA,
W71-04269 05D

WATER RIGHTS
PRINCIPLES OF WATER RIGHTS LAW IN OHIO,
W71-04022 06E

COMPETITION FOR WATER IN AN EXPANDING ECONOMY POLICIES AND INSTITUTIONS,
W71-04268 06E

KIRK V PROVIDENCE MILL CO (SURPLUS WATER RIGHTS SUBJECT TO STATE'S RIGHT TO ABANDON AND DRAIN CANAL).
W71-04344 06E

WATER STRUCTURE
STRUCTURE OF WATER IN MICROEMULSIONS ELECTRICAL, BIREFRINGENCE, AND NUCLEAR MAGNETIC RESONANCE STUDIES,
W71-04108 01B

WATER SUPPLY
SYSTEMS ANALYSIS FOR WATER SUPPLY AND POLLUTION CONTROL,
W71-03857 06A

WATER, A PROGRESS REPORT.
W71-03905 08A

ENGINEERING EVALUATION OF FACTORS AFFECTING QUALITY OF WATER SOURCES AVAILABLE FOR SALINE WATER CONVERSION PLANTS,
W71-03916 03A

WATER SUPPLY OUTLOOK FOR THE WESTERN UNITED STATES, 1970-71 WATER YEAR.
W71-03927 02B

OPTIMAL OPERATION OF WATER SUPPLY SYSTEMS,
W71-04042 04B

GEOGRAPHICAL ASPECTS OF THE USE OF WATER RESOURCES IN THE SOVIET ECONOMY,
W71-04052 03F

PROGRESS IN WATER DESALINATION TECHNOLOGY,
W71-04229 03A

PENNSYLVANIA RR V LINCOLN TRUST CO (RAILROAD AND MUNICIPAL NEGLIGENCE IN MAINTAINING WATER PURITY).
W71-04252 06E

CITY OF SALEM V HARDING (CITY'S NEGLIGENCE IN CAUSING ILLNESS BY CONTAMINATION OF WATER SUPPLY).
W71-04278 06E

WIESNER V CITY OF ALBANY (MUNICIPAL LIABILITY FOR TYPHOID EPIDEMIC CAUSED BY DEFECTIVE PIPELINE).
W71-04322 06E

WATER USE IN TENNESSEE, PART D - SUMMARY,
W71-04324 06D

WATER TABLE
WATER TABLE DECLINE AND RESULTANT AGRICULTURAL PATTERNS IN THE SALT RIVER VALLEY OF ARIZONA,
W71-04065 03F

WATER TEMPERATURE
ESTIMATION OF SEA SURFACE TEMPERATURE FROM SPACE,
W71-03959 07B

SOME CHARACTERISTICS OF THE THERMAL REGIME OF RIVERS IN THE DANUBE AND DNIESTER BASINS,
W71-03974 02K

ECONOMICS OF THERMAL POLLUTION CONTROL,
W71-04084 05D

WATER TRANSFER

WATER, A PROGRESS REPORT.
W71-03905 08A

WATER USERS
CITY OF LEXINGTON V LEXINGTON WATER CO (WATER COMPANY'S PROFIT IN LAND SALE NOT RELEVANT IN FIXING RATES).
W71-04316 06E

WATER UTILIZATION
WATER RIGHTS LAW AND MANAGEMENT IN WEST VIRGINIA -- FUTURE NEEDS AND ALTERNATIVES,
W71-03880 06E

ECOLOGICAL SIGNIFICANCE OF ALIEN PLANTS IN CALIFORNIA GRASSLANDS,
W71-04233 04A

SPATIAL PATTERNS OF SOCIO-ECONOMIC STRUCTURE IN INDIA,
W71-04234 06B

WATER AND CULTURE NEW DECISION RULES FOR OLD INSTITUTIONS,
W71-04296 06E

PUBLIC WATER POLICY IN TENNESSEE.
W71-04308 06E

WATER USE IN TENNESSEE, PART D - SUMMARY,
W71-04324 06D

WATER-USE LAW IN MISSOURI,
W71-04339 06E

WATER VAPOR
A MORE RIGOROUS EXPRESSION FOR THE RATE OF DROPLET GROWTH,
W71-04005 03B

WATER WELLS
AVAILABILITY OF GROUNDWATER IN WESTERN COWLITZ COUNTY, WASHINGTON,
W71-03934 02F

GROUNDWATER RESOURCES OF COLLINGSWORTH COUNTY, TEXAS,
W71-03935 02F

GEOLOGY AND GROUNDWATER RESOURCES OF ALLEN COUNTY, KANSAS,
W71-03937 02F

WATER WORKS
ELKHORN CITY LAND CO V ELKHORN CITY (ABANDONMENT OF WATER WORKS PROPERTY).
W71-04313 06E

CITY OF LEXINGTON V LEXINGTON WATER CO (WATER COMPANY'S PROFIT IN LAND SALE NOT RELEVANT IN FIXING RATES).
W71-04316 06E

WATER YIELD
A METHOD FOR THE COMPUTATION OF WATER YIELD FROM SNOW DURING SNOWMELT PERIOD,
W71-04172 02C

SOME RESULTS OF INVESTIGATION AND REPRESENTATION OF SNOW SUPPLY AND THE MELTING OF SNOW,
W71-04174 02C

RUNOFF CONDITIONS DURING SNOW THAWING IN THE MORAVIAN-SILESIAN BESKIDS,
W71-04175 02C

ANALYSIS OF SNOW MELT FLOODS,
W71-04179 02E

ESTIMATION OF THE WATER SUPPLY FROM SNOW COVER IN THE SOUTHERN PART OF THE GERMAN D. R. IN SPRING 1965,
W71-04180 02C

WATERSHED MANAGEMENT IN THE UNITED STATES CONCEPTS AND PRINCIPLES,
W71-04253 03B

WATER YIELD IMPROVEMENT
INCREASES IN WATER YIELD FOLLOWING CLEAR-CUT LOGGING IN THE PACIFIC NORTHWEST,
W71-04240 03B

SOIL MOISTURE DEPLETION AND ESTIMATED EVAPOTRANSPIRATION ON UTAH MOUNTAIN WATERSHED,
W71-04242 02D

THE MANAGEMENT OF FORESTED WATERSHEDS FOR DOMESTIC WATER SUPPLIES,
W71-04244 06A

WATERSHED MANAGEMENT IN THE UNITED STATES CONCEPTS AND PRINCIPLES,
W71-04253 03B

WATERCOURSES(LEGAL)
LAW OF SEASHORE, WATERS AND WATERCOURSES OF MAINE AND MASSACHUSETTS,
W71-04257 04A

WATERSHED MANAGEMENT
THE SAN SIMON WATERSHED SHRUB CONTROL,
W71-04058 03F

WATERSHED PROJECTS.
W71-04104 06E

THE MANAGEMENT OF FORESTED WATERSHEDS FOR DOMESTIC WATER SUPPLIES,
W71-04244 06A

WATERSHED MANAGEMENT IN THE UNITED STATES CONCEPTS AND PRINCIPLES,
W71-04253 03B

WATERSHED MODELS
THE INFLUENCE OF LANDFORM AND PRECIPITATION PARAMETERS ON FLOOD HYDROGRAPHS,
W71-03871 02E

WATERSHED PROTECTION
WATERSHED MANAGEMENT IN THE UNITED STATES CONCEPTS AND PRINCIPLES,
W71-04253 03B

WATERSHED REHABILITATION
WATERSHED MANAGEMENT IN THE UNITED STATES CONCEPTS AND PRINCIPLES,
W71-04253 03B

WATERSHEDS
WATERSHED MANAGEMENT IN THE UNITED STATES CONCEPTS AND PRINCIPLES,
W71-04253 03B

WATERSPACE
WATER AND CULTURE NEW DECISION RULES FOR OLD INSTITUTIONS,
W71-04296 06E

WATERY PROCESS WASTES
WASTE CONTROL HIGHLIGHTS PLANT DESIGN.
W71-03899 05D

WEATHER FORECASTING
QUANTITATIVE REGIONAL PREDICTION OF RAINFALL IN ECAFE REGIONS,
W71-04152 02B

VERTICAL VELOCITY AND RAINFALL COMPUTATION,
W71-04153 02B

DETECTION OF PRECIPITATION BY RADAR,
W71-04154 07B

ANALYSIS OF MESOSCALE SYSTEMS,
W71-04157 02B

SURVEY OF OBJECTIVE METHODS USED IN HONG KONG FOR PREDICTING TYPHOON MOVEMENT,
W71-04158 02B

LECTURE 1 - FACTORS INFLUENCING RAINFALL FORMATION AND DISTRIBUTION,
W71-04160 02B

WEATHER PATTERNS
DETECTION OF PRECIPITATION BY RADAR,
W71-04154 07B

WEATHERING
A GEOCHEMICAL TREND IN SILICON-ALUMINUM-IRON RATIOS AND THE CLASSIFICATION OF CLASTIC SEDIMENTS,
W71-03945 02K

WEIRS
THE UNIVERSALISATION OF THE CO-ORDINATES OF LOGARITHMIC WEIR PROFILES,
W71-04127 07B

EXPERIMENTAL STUDIES ON LINEAR PROPORTIONAL WEIRS WITH TRIANGULAR BOTTOMS,
W71-04129 08B

WEIRS(LOGARITHMIC SECTION)
THE UNIVERSALISATION OF THE CO-ORDINATES OF LOGARITHMIC WEIR PROFILES,
W71-04127 07B

WEIRS(TRIANGULAR SECTION)
EXPERIMENTAL STUDIES ON LINEAR PROPORTIONAL WEIRS WITH TRIANGULAR BOTTOMS,
W71-04129 08B

WELL LOGGING TERMS(GLOSSARY)
GLOSSARY OF TERMS USED IN WELL LOGGING,
W71-04113 10

WELLS
GLOSSARY OF TERMS USED IN WELL LOGGING,
W71-04113 10

THE PUMPED WELL,
W71-04292 04B

WEST AFRICA
FARMING, FOREST AND SAVANNA IN WESTERN NIGERIA,
W71-04054 03F

POTENTIAL EVAPOTRANSPIRATION AND THE WATER BALANCE IN WEST AFRICA AN ALTERNATIVE METHOD OF PENMAN,
W71-04063 02D

WEST VIRGINIA
WATER RIGHTS LAW AND MANAGEMENT IN WEST VIRGINIA -- FUTURE NEEDS AND ALTERNATIVES,
W71-03880 06E

MINE ACID DRAINAGE AND ASSOCIATED FLOW FLUCTUATIONS,
W71-03938 05B

WESTERN GULF OF MEXICO BASINS
QUALITY OF SURFACE WATERS OF THE UNITED STATES, 1965 PARTS 7 AND 8. LOWER MISSISSIPPI RIVER BASIN AND WESTERN GULF OF MEXICO BASINS.
W71-04048 02K

WETTABILITY
WETTING AGENT FAILS TO CURB EROSION FROM BURNED WATERSHED,
W71-04250 04D

WETTING FRONT
DETERMINATION OF SOIL PERMEABILITY BY THE METHOD OF LARGE RINGS,
W71-04006 02G

WET-MANTLE FLOODS
DO CONTOUR TRENCHES REDUCE WET-MANTLE FLOOD PEAKS,
W71-04262 04A

WHEAT
INFLUENCE OF MANAGEMENT AND ENVIRONMENTAL FACTORS ON EXTENT OF SOIL WATER DEPLETION BY SPRING WHEAT,
W71-04303 03F

WILTING POINT
LEAF SAMPLER FOR RELATIVE WATER CONTENT MEASUREMENTS DESIGN AND APPLICATION,
W71-04239 02I

WINDS
THE CLIMATE OF INTERIOR OMAN,
W71-04227 02B

WITHDRAWAL
WATER TABLE DECLINE AND RESULTANT AGRICULTURAL PATTERNS IN THE SALT RIVER VALLEY OF ARIZONA,
W71-04065 03F

WYOMING
WATER-QUALITY DATA FOR THE FLAMING GORGE RESERVOIR AREA, UTAH AND WYOMING,
W71-03936 07C

XEROPHYTES
FORMATION OF PHYTOGENIC HILLOCKS II. ROOTING HABIT OF PLANTS FORMING PHYTOGENIC HILLOCKS,
W71-04295 02I

X-RAY ANALYSIS
STRUCTURE OF WATER IN MICROEMULSIONS ELECTRICAL, BIREFRINGENCE, AND NUCLEAR MAGNETIC RESONANCE STUDIES,
W71-04108 01B

ZINC
PEDOGENIC DISTRIBUTION OF ZINC IN MOLLISOLS AND ASSOCIATED ENTISOLS IN NEBRASKA,
W71-03940 02G

ZINC DISTRIBUTION(SOILS)
PEDOGENIC DISTRIBUTION OF ZINC IN MOLLISOLS AND ASSOCIATED ENTISOLS IN NEBRASKA,
W71-03940 02G

ZONING
CORCORAN V VILLAGE OF BENNINGTON (RIGHT TO WATER AND SEWER SERVICE PERMITS).
W71-04071 06E

ZOOPLANKTON
METHODS OF COLLECTION AND ANALYSIS OF PLANKTON AND PERIPHYTON SAMPLES IN THE WATER POLLUTION SURVEILLANCE SYSTEM,
W71-04195 05A

AUTHOR INDEX

ADAMS, TOM
THE POLITICS OF WATER,
W71-04091 06E

AHMED, FAIZ
MAXIMUM DISCHARGE OF MAJOR RIVERS IN LARGE FLOOD PLAINS IN EAST PAKISTAN,
W71-03986 02E

ALBERTOVA, O.
THE EFFECT OF SOME SOLVENTS ON LOWER WATER ANIMALS AND ON FISHES,
W71-03854 05C

ALDON, EARL F.
FOURWING SALTBUSH CAN BE FIELD PLANTED SUCCESSFULLY,
W71-04247 04A

ALEXANDER, JULIAN M.
THE PROPOSED POTOMAC RIVER BASIN COMPACT,
W71-04090 06E

ALGER, GEORGE R.
WASTE WATER RESULTING FROM THE CONCENTRATION OF LOW GRADE IRON ORE,
W71-04083 05D

ALLEN, R. M.
ROOTSTOCKS FOR VALENCIA ORANGES AND LIBSON LEMONS IN ARIZONA,
W71-04059 03F

AL-RAWI, A. H.
MINERALOGY OF SOME ARID AND SEMIARID LAND SOILS OF IRAQ,
W71-04061 02G

AMBE, YOSHINARI
SECULAR VARIATION OF ARIDITY IN THE WORLD,
W71-04288 02A

AMOROCHO, JAIME
A SIMPLE CASCADE WATERSHED MODEL,
W71-04181 02A

ANDERSON, FRANZ E.
THE PERIODIC CYCLE OF PARTICULATE MATTER IN A SHALLOW, TEMPERATE ESTUARY,
W71-03943 02L

ANDERSON, J. B.
ARTIFICIAL SUBSTRATE SAMPLING, MACROINVERTEBRATES IN A POLLUTED REACH OF THE KLAMATH RIVER, OREGON,
W71-04191 05A

A LIMESTONE-FILLED, ARTIFICIAL SUBSTRATE SAMPLER-FLOAT UNIT FOR COLLECTING MACROINVERTEBRATES IN LARGE STREAMS,
W71-04219 07B

ANDING, D.
ESTIMATION OF SEA SURFACE TEMPERATURE FROM SPACE,
W71-03959 07B

ANDREWS, JOHN F.
MULTI-STAGE BIOLOGICAL PROCESSES FOR WASTE TREATMENT,
W71-03894 05D

ANDREWS, J. F.
KINETICS OF FIXED FILM BIOLOGICAL REACTORS,
W71-04085 05D

ANDRYANOVA, M. A.
STRESS DISTRIBUTION INSIDE HOMOGENEOUS ROCK-TALUS DAMS,
W71-04003 08A

ANGLE, ROBERT D.
WATER-USE LAW IN MISSOURI,
W71-04339 06E

AOKI, S.
ANALYSIS OF SNOW MELT FLOODS,
W71-04179 02E

ARMSTRONG, R.
PROTOTYPE STUDIES OF COMBINED TREATMENT OF WASTES FROM 22 TANNERIES AND TWO MUNICIPALITIES,
W71-03892 05D

ARNASON, B.
EXCHANGE OF DEUTERIUM BETWEEN ICE AND WATER IN GLACIOLOGICAL STUDIES IN ICELAND,
W71-04137 02A

ASHLEY, LAURENCE M.
ACTION OF IRON SALTS IN SOLUTION ON GOLDFISH,
W71-03851 05C

ASKEW, ARTHUR J.
OPTIMUM FIRE POWER OUTPUT FROM A TWO RESERVOIR SYSTEM BY INCREMENTAL DYNAMIC PROGRAMMING,
W71-04111 04A

ASKEW, M. W.
HIGH-RATE BIOFILTRATION PAST AND FUTURE,
W71-04076 05D

ATKINSON, T. D.
A WINTER LIMNOLOGICAL STUDY OF LAKE WILCOX A FRESHWATER IMPOUNDMENT,
W71-03957 02H

AUNG, HTAY
SEVERE CYCLONIC STORM RESPONSIBLE FOR FLASH FLOOD IN PAKOKKU AND MONYWA DISTRICTS DURING THE MONTH OF OCTOBER 1967,
W71-04164 02B

AUSNESS, RICHARD
WATER QUALITY CONTROL A MODERN APPROACH TO STATE REGULATION,
W71-04101 06E

AYERS, H. D.
DERIVATION OF A GENERAL FLOOD WAVE HYDROGRAPH FROM A CONTINUOUS WATERSHED WATER BALANCE,
W71-03989 02E

BAILEY, ROBERT G.
THE EFFECT OF VEGETATION CONVERSION AND FLOOD DISCHARGE ON STREAM CHANNEL GEOMETRY THE CASE OF SOUTHERN CALIFORNIA WATERSHEDS,
W71-04230 04D

BAILEY, WAYNE E.
THE STRUCTURE AND MORPHOLOGY OF INORGANIC MEMBRANES,
W71-04224 03A

BAILLOD, C. ROBERT
WASTE WATER RESULTING FROM THE CONCENTRATION OF LOW GRADE IRON ORE,
W71-04083 05D

BAKER, ROBERT A.
A CASE STUDY OF MICROORGANIC CONTAMINANTS IN RIVER WATER,
W71-04119 05A

BALEK, J.
DERIVATION OF A GENERAL FLOOD WAVE HYDROGRAPH FROM A CONTINUOUS WATERSHED WATER BALANCE,
W71-03989 02E

BALLINGER, DWIGHT G.
ANALYTICAL INSTRUMENTS IN WATER POLLUTION CONTROL,
W71-04205 05A

BANERJI, S.
DETERMINATION OF THE DISTRIBUTION OF RAINFALL FLOODS IN LARGE CATCHMENTS USING HYDROMETEOROLOGICAL DATA,
W71-03977 02E

BARBOUR, EDMUND
A GUIDE TO USING INTEREST FACTORS IN ECONOMIC ANALYSIS OF WATER PROJECTS,
W71-04283 06B

BARLOW, JOHN P.
EUTROPHICATION OF WATER RESOURCES OF NEW YORK STATE, OBSERVATIONS ON NUTRIENT LIMITATION ON SUMMER PHYTOPLANKTON IN CAYUGA LAKE, 1967 AND 1968,
W71-03923 02H

BARNHISEL, R. I.
THE DIFFUSION OF COPPER, MANGANESE, AND ZINC AS AFFECTED BY CONCENTRATION, CLAY MINERALOGY, AND ASSOCIATED ANIONS,
W71-03942 02G

BARRY, P. J.
PERCH LAKE EVAPORATION STUDY,
W71-04142 02A

BATANOUNY, K. H.
FORMATION OF PHYTOGENIC HILLOCKS II. ROOTING HABIT OF PLANTS FORMING PHYTOGENIC HILLOCKS,
W71-04295 02I

ROOT DEVELOPMENT OF TWO COMMON SPECIES IN DIFFERENT HABITATS IN THE MEDITERRANEAN SUBREGION IN EGYPT,
W71-04300 02I

BATANOUNY, M. H.
FORMATION OF PHYTOGENIC HILLOCKS II. ROOTING HABIT OF PLANTS FORMING PHYTOGENIC HILLOCKS,
W71-04295 02I

BAUER, ARMAND
INFLUENCE OF MANAGEMENT AND ENVIRONMENTAL FACTORS ON EXTENT OF SOIL WATER DEPLETION BY SPRING WHEAT,
W71-04303 03F

BAUM, BERNARD
POROUS TUBULET SUPPORTS FOR DESALINATION BARRIERS,
W71-03911 03A

BEASLEY, M. L.
THE STRUCTURE AND MORPHOLOGY OF INORGANIC MEMBRANES,
W71-04224 03A

BEATLEY, JANICE C.
PERENNATION IN ASTRAGALUS LENTIGINOSUS AND TRIDENS PULCHELLUS IN RELATION TO RAINFALL,
W71-04299 02I

BENTLEY, P. A.
THE ROLE OF AQUATIC VASCULAR PLANTS IN THE EUTROPHICATION OF SELECTED LAKES IN WASTERN MASSACHUSETTS,
W71-03918 05C

BERNARD, EDWARD G.
FABRICATION OF FELT-MEMBRANE COMPOSITES,
W71-04222 03A

BERNIER, J.
DETERMINATION OF MAXIMUM FLOOD FLOW AND THE PROBABILITY OF ITS BEING EXCEEDED, USING INCOMPLETE INFORMATION (FRENCH),
W71-03979 02E

BERTHOUEX, PAUL M.
DESIGN CAPACITIES TO ACCOMMODATE FORECAST UNDERTAINTIES,
W71-04026 06A

BESSER, YA
HOT-THERMOS METHOD OF CONCRETING,
W71-03997 08F

BHAPPER, ROSHAN B.
WASTE PROBLEMS RELATIVE TO MINING AND MILLING OF MOLYBDENUM,
W71-03888 05D

BIERZANEK, R.
TOWARDS A BETTER USE OF THE OCEAN CONTEMPORARY LEGAL PROBLEMS IN OCEAN DEVELOPMENT,
W71-04338 06E

BIKERMAN, J. J.
TREATMENT OF ACID MINE DRAINAGE BY FOAM SEPARATION,
W71-04188 05D

BLOCK, JACOB
CHEMICAL EXFOLIATED VERMICULITE FOR REMOVAL OF PHOSPHATE FROM WASTE WATERS,
W71-04107 05D

BOLITHO, V.
A LONG-TERM PLAN FOR SEWERAGE DEVELOPMENT IN THE JOHANNESBURG REGION,
W71-03895 05G

BOOTH, ROBERT L.
METHOD SELECTION STUDY 1 A COMPARISON OF THREE MODIFICATIONS OF THE SINGLE REAGENT METHOD FOR SOLUBLE ORTHOPHOSPHATE,
W71-04204 05A

BOOTH, R. L.
EVALUATION REPORT 1 AUTOMATIC BEAKER SAMPLE CHANGER,
W71-04192 07B

BORODIN, N. P.
SARATOV HYDROELECTRIC POWERPLANT CONSTRUCTION DATA,
W71-04017 08C

BOSTROM, KURT
SUBMARINE VOLCANISM AS A SOURCE FOR IRON,
W71-03955 02K

BOVET, ERIC D.
INDUSTRIAL WASTE DESALTING FOR BYPRODUCT RECOVERY,
W71-04286 05D

BOYD, C. C.
SOLUBILITY AND AVAILABILITY OF SORBED SULFATE IN HAWAIIAN SOILS,
W71-03941 02G

BROWNLIE, I.
TOWARDS A BETTER USE OF THE OCEAN CONTEMPORARY LEGAL PROBLEMS IN OCEAN DEVELOPMENT,
W71-04338 06E

BROWN, L. H.
AGROMETEOROLOGY SURVEY OF THE HIGHLANDS OF EASTERN AFRICA,
W71-04062 02D

BROWN, RAY W.
MEASUREMENT OF WATER POTENTIAL WITH THERMOCOUPLE PSYCHROMETERS CONSTRUCTION AND APPLICATIONS,
W71-04237 02I

WATER POTENTIAL MEASUREMENTS IN TRESS,
W71-04238 02I

LEAF SAMPLER FOR RELATIVE WATER CONTENT MEASUREMENTS DESIGN AND APPLICATION,
W71-04239 02I

BROWN, R. M.
DISTRIBUTION OF HYDROGEN ISOTOPES IN CANADIAN WATERS,
W71-04134 02A

BUKOVSZKY, G.
ANALISIS OF THE RELATION BETWEEN PRECIPITATION AND FLOOD FLOW WITH THE AID OF A TRIPLE TRANSFORMATION BASED ON THE UNIT HYDROGRAPH METHOD (FRENCH),
W71-03980 02A

BULTMAN, J. D.
SURFACE CHEMISTRY STUDIES ON THE BAY OF PANAMA,
W71-04001 02L

BUNCH, ROBERT L.
BIODEGRADABILITY OF POTENTIAL ORGANIC SUBSTITUTES FOR PHOSPHATES,
W71-04072 05D

BURBY, RAYMOND J.
1969 RESERVOIR LAND USE SURVEYS FIELD REPORT AND PROCEDURAL MANUAL,
W71-04039 04A

BURCHAM, L. T.
ECOLOGICAL SIGNIFICANCE OF ALIEN PLANTS IN CALIFORNIA GRASSLANDS,
W71-04233 04A

BURKE, W. T.
TOWARDS A BETTER USE OF THE OCEAN CONTEMPORARY LEGAL PROBLEMS IN OCEAN DEVELOPMENT,
W71-04338 06E

BURT, OSCAR R.
GROUNDWATER STORAGE CONTROL UNDER INSTITUTIONAL RESTRICTIONS,
W71-04024 04B

BUTLER, JAMES N.
THE USE OF AMALGAM ELECTRODES TO MEASURE ACTIVITY COEFFICIENTS IN MULTICOMPONENT SALT SOLUTIONS,
W71-04221 01B

BYSHOVETS, L. B.
A METHOD FOR THE CALCULATION OF SPRING FLOODS,
W71-04178 02E

CALLAHAN, CHARLES C.
PRINCIPLES OF WATER RIGHTS LAW IN OHIO,
W71-04022 06E

CALL, P. DAVID
UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME V. ANALYSIS OF APPLYING STANDARDIZATION TECHNIQUES TO OCEANOGRAPHIC SENSORS,
W71-04013 07B

CAMPBELL, ERIC
WATER POTENTIAL MEASUREMENTS IN TRESS,
W71-04238 02I

CAMPBELL, IAN A.
CLIMATE AND OVERGRAZING ON THE SHONTO PLATEAU, ARIZONA,
W71-04064 03F

CAMPBELL, ROBERT S.
THE EVALUATION OF ENVIRONMENTAL ALTERATION BY THERMAL LOADING AND ACID POLLUTION IN THE COOLING RESERVOIR OF A STEAM-ELECTRIC STATION,
W71-04019 05C

CANALE, RAYMOND P.
PREDATOR-PREY RELATIONSHIPS IN A MODEL FOR THE ACTIVATED PROCESS,
W71-04070 05D

CARROLL, HENRY C.
MINE ACID DRAINAGE AND ASSOCIATED FLOW FLUCTUATIONS,
W71-03938 05B

CASS, THOMAS
UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME I. STATE-OF-THE-ART OF OCEANOGRAPHIC AND METEOROLOGICAL SENSORS, TUTORIAL DISCUSSION,
W71-04009 07B

CASTON, V. N. D.
TIDAL SAND MOVEMENT BETWEEN SOME LINEAR SAND BANKS IN THE NORTH SEA OFF NORTHEAST NORFOLK,
W71-03953 02J

CHALMERS, R. K.
PRETREATMENT OF TOXIC WASTES,
W71-04082 05D

CHANDRASEKARAN, D.
THE UNIVERSALISATION OF THE CO-ORDINATES OF LOGARITHMIC WEIR PROFILES,
W71-04127 07B

CHAPMAN, W. M.
TOWARDS A BETTER USE OF THE OCEAN CONTEMPORARY LEGAL PROBLEMS IN OCEAN DEVELOPMENT,
W71-04338 06E

CHELAM, E. V.
QUANTITATIVE REGIONAL PREDICTION OF RAINFALL IN ECAFE REGIONS,
W71-04152 02B

VERTICAL VELOCITY AND RAINFALL COMPUTATION,
W71-04153 02B

CHIDLEY, T. R. E.
A RAPID METHOD OF COMPUTING AREAL RAINFALL,
W71-04123 07B

CHIN, P. C.
DETECTION OF PRECIPITATION BY RADAR,
W71-04154 07B

ANALYSIS OF RAINFALL OVER A SMALL AREA,
W71-04155 02B

RAIN FROM TROPICAL CYCLONES AND TROUGH-TYPE SYSTEMS,
W71-04156 02B

ANALYSIS OF MESOSCALE SYSTEMS,
W71-04157 02B

SURVEY OF OBJECTIVE METHODS USED IN HONG KONG FOR PREDICTING TYPHOON MOVEMENT,

W71-04158 02B

CHOW, VEN TE
ANALYSIS OF STOCHASTIC HYDROLOGIC SYSTEMS,
W71-03869 02A

CHUMICHEV, YU. E.
PRECAST REINFORCED CONCRETE IN HYDRAULIC CONSTRUCTION,
W71-04015 08F

CLAUSEN, GEORGE SAMUEL
OPTIMAL OPERATION OF WATER SUPPLY SYSTEMS,
W71-04042 04B

CLESCERI, LENORE S.
SOLIDS SEPARATION BY ULTRAFILTRATION FOR CONCENTRATED ACTIVATED SLUDGE,
W71-04087 05D

CLEVELAND, JERRY C.
A MULTI-PHASIC COMPONENT STUDY TO PREDICT STORM WATER POLLUTION FROM URBAN AREAS,
W71-03917 05C

CLIFFORD, HUGH F.
LIMNOLOGICAL FEATURES OF A NORTHERN BROWN-WATER STREAM, WITH SPECIAL REFERENCES TO THE LIFE HISTORIES OF THE AQUATIC INSECTS,
W71-04215 05C

COCHEME, J.
AGROMETEOROLOGY SURVEY OF THE HIGHLANDS OF EASTERN AFRICA,
W71-04062 02D

COE, JACK J.
EFFECT OF SOLID WASTE DISPOSAL ON GROUNDWATER QUALITY,
W71-04116 05C

COOKSON, JOHN T., JR.
DESIGN OF ACTIVATED CARBON ADSORPTION BEDS,
W71-03897 05D

CORBETT, EDWARD S.
THE MANAGEMENT OF FORESTED WATERSHEDS FOR DOMESTIC WATER SUPPLIES,
W71-04244 06A

CORY, ROBERT L.
COST OF PATUXENT RIVER QUALITY MONITORING,
W71-04115 05A

COX, E. B.
SECOND REPORT ON HORIZONTAL-TUBE MULTIPLE-EFFECT PROCESS PILOT PLANT TESTS AND DESIGN,
W71-04220 03A

CRABB, PETER
ASPECTS OF THE SOUTH AUSTRALIAN CITRUS INDUSTRY,
W71-04051 03F

CROSBY, ROBERT M.
UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME I. STATE-OF-THE-ART OF OCEANOGRAPHIC AND METEOROLOGICAL SENSORS, TUTORIAL DISCUSSION,
W71-04009 07B

UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME II. STATE-OF-THE-ART OF OCEANOGRAPHIC AND METEOROLOGICAL SENSORS, CATALOG,
W71-04010 07B

UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME III. THE SURVIVAL ENVIRONMENT FOR OCEANOGRAPHIC AND METEOROLOGICAL SENSORS,
W71-04011 07B

CYWIN, ALLEN
AN OVERVIEW OF U.S. DEPARTMENT OF INTERIOR'S ROLE IN SEDIMENT CONTROL,
W71-04147 04D

DAND, P. D.
MODELING AND OPTIMIZATION OF WATER RESOURCES SYSTEMS - PHASE I,
W71-04043 06A

OPTIMIZATION OF WATER RESOURCES SYSTEMS BY THE GRADIENT PROJECTION METHOD,
W71-04047 06A

DANIELSON, R. E.
EVALUATION OF IRRIGATION WATER AND NITROGEN FERTILIZER IN CORN PRODUCTION,
W71-04304 03F

DANIEL, T. W.
WATER POTENTIAL MEASUREMENTS IN TRESS,
W71-04238 02I

DANIEL, WILTON J., JR.
UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME IV. THE FORMATTING AND TRANSMISSION OF DATA FROM OCEANOGRAPHIC SENSORS,
W71-04012 07B

DANKERT, WAYNE M.
PEDOGENIC DISTRIBUTION OF ZINC IN MOLLISOLS AND ASSOCIATED ENTISOLS IN NEBRASKA,
W71-03940 02G

DARMER, KENNETH I.
A PROPOSED STREAMFLOW DATA PROGRAM FOR NEW YORK,
W71-03933 07A

DATTA, R. K.
EVALUATION OF MAXIMUM RAINFALL DISCHARGE FROM A REGION OF DEFICIENT RAINFALL DATA,
W71-03978 02E

DAVIS, B.
BIOLOGICAL CHEMICAL COMBINATION DRAMATICALLY CUTS TREATMENT,
W71-04086 05D

DAVIS, P. R.
COMPUTER AIDS GROUNDWATER RESOURCES RESEARCH PROJECT,
W71-04057 02F

DAWES, JULIUS H.
TOOLS FOR WATER-RESOURCE STUDY,
W71-04027 06A

DE BYLE, NORBERT V.
SOIL FREEZING DETERMINED WITH FOUR TYPES OF WATER-FILLED TUBES,
W71-04251 07B

DE VRIES, M.
ON THE ACCURACY OF BED-MATERIAL SAMPLING,
W71-04132 02J

DEAN, DAVID
WATER QUALITY - BENTHIC INVERTEBRATE RELATIONSHIPS IN ESTUARIES,
W71-03922 05C

DEBYLE, NORBERT V.
DO CONTOUR TRENCHES REDUCE WET-MANTLE FLOOD PEAKS,
W71-04262 04A

INFILTRATION IN CONTOUR TRENCHES IN THE SIERRA NEVADA,
W71-04263 04A

VERIFYING RECORDING PRECIPITATION GAUGE RECORDS,
W71-04264 07C

DECOOK, KENNETH JAMES
ECONOMIC FEASIBILITY OF SELECTIVE ADJUSTMENT IN USE OF SALVAGEABLE WATERS IN THE TUCSON REGION, ARIZONA,
W71-04269 05D

DEGROAT, JAMES J.
COMPUTER DESIGN OF SEWAGE TREATMENT PLANTS,
W71-03893 05D

DEIG, N. G.
STRUCTURE OF PUBLICLY-OWNED WATER UTILITIES,
W71-04281 06E

DEININGER, ROLF A.
SYSTEMS ANALYSIS FOR WATER SUPPLY AND POLLUTION CONTROL,
W71-03857 06A

DENNEN, WILLIAM H.
A GEOCHEMICAL TREND IN SILICON-ALUMINUM-IRON RATIOS AND THE CLASSIFICATION OF CLASTIC SEDIMENTS,
W71-03945 02K

DENNIS, R. E.
ELEVATION AND TEMPERATURE EFFECTS ON SEVERITY OF MAIZE DWARF MOSAIC VIRUS IN SORGHUM,
W71-04060 03F

DHARMADHIKARI, VISHNU V.
QUALITY OF RUNOFF FROM DIVERSIFIED URBAN WATERSHEDS,
W71-03929 05A

DHRUVA, RILEY
HYDROGRAPH SYNTHESIS FOR WATERSHED SUBZONES FROM MEASURED URBAN PARAMETERS,
W71-04184 04C

DI LUZIO, FRANK C.
ENGINEERING EVALUATION OF FACTORS AFFECTING QUALITY OF WATER SOURCES AVAILABLE FOR SALINE WATER CONVERSION PLANTS,
W71-03916 03A

DIEHL, W. R.
POROUS TUBULET SUPPORTS FOR DESALINATION BARRIERS,
W71-03911 03A

DILLIN, DENNIS R.
THE STRUCTURE AND MORPHOLOGY OF INORGANIC MEMBRANES,
W71-04224 03A

DINCER, T.
VARIATION OF THE TRITIUM AND OXYGEN-18 CONTENT IN PRECIPITATION AND SNOWPACK IN A REPRESENTATIVE BASIN IN CZECHOSLOVAKIA,
W71-04135 02A

DIRECTO, LEON S.
UTILIZATION OF THE STORAGE POTENTIAL OF RIVER VALLEY AQUIFERS,
W71-03924 02F

DOLGOPOLOV, K. V.
GEOGRAPHICAL ASPECTS OF THE USE OF WATER RESOURCES IN THE SOVIET ECONOMY,
W71-04052 03F

DOTY, ROBERT D.
SOIL MOISTURE DEPLETION AND ESTIMATED EVAPOTRANSPIRATION ON

UTAH MOUNTAIN WATERSHED,
W71-04242 02D

DOUGAL, MERWIN D.
INTERACTION AMONG NATURAL RESOURCE SYSTEMS, THE DECISION MAKERS AND THE PUBLIC IN THE 2000'S,
W71-03868 06B

DOUGLAS, A. S.
MEMBRANE MATERIALS FOR WASTE WATER RECLAMATION BY REVERSE OSMOSIS,
W71-04185 05D

DRACUP, JOHN A.
WATER RESOURCES SYSTEMS ENGINEERING,
W71-03885 06A

DRACUP, J. A.
OPTIMIZATION OF WATER RESOURCE SYSTEMS INCORPORATING EARTHQUAKE RISK PROGRESS REPORT NO 1,
W71-04041 06A

DRESSMAN, RONALD C.
ELIMINATION OF 'MEMORY' PEAKS ENCOUNTERED IN AQUEOUS-INJECTION GAS CHROMATOGRAPHY,
W71-04196 07B

PESTICIDES IN SURFACE WATERS OF THE UNITED STATES A FIVE-YEAR SUMMARY 1964-1968,
W71-04201 05A

DREW, JAMES V.
PEDOGENIC DISTRIBUTION OF ZINC IN MOLLISOLS AND ASSOCIATED ENTISOLS IN NEBRASKA,
W71-03940 02G

DREW, JEAN T.
CONTINENTAL SHELF LAW OUTDISTANCED BY SCIENCE AND TECHNOLOGY,
W71-04100 06E

DREYER, I. N.
MAP OF TOTAL STREAMFLOW FROM THE TERRITORY OF THE SOVIET UNION,
W71-03960 02E

DUKE, C. M.
OPTIMIZATION OF WATER RESOURCE SYSTEMS INCORPORATING EARTHQUAKE RISK PROGRESS REPORT NO 1,
W71-04041 06A

DUNSCOMBE, CARROLL
RIPARIAN AND LITTORAL RIGHTS A SURVEY OF SOME OF THE LEGAL PROBLEMS INVOLVED IN RESIDENTIAL AND COMMERCIAL USES ALONG THE WATER'S EDGE IN RELATION TO THE SUBSTANTIVE ASPECTS OF PUBLIC POLICY,
W71-04095 06E

DUSCHATKO, ROBERT W.
USE OF PORE CASTS AND SCANNING ELECTRON MICROSCOPE TO STUDY PORE GEOMETRY,
W71-03946 07B

DYUKEL, M. G.
SOME CHARACTERISTICS OF THE THERMAL REGIME OF RIVERS IN THE DANUBE AND DNIESTER BASINS,
W71-03974 02K

D'ANNUNZIO, JOSEPH D.
CAN COSTS BE CUT,
W71-04284 06C

EARL, THOMAS C.
ECONOMIC CONSIDERATIONS IN FACILITY PLANNING,
W71-04285 06B

EBERHARDT, W. A.
CHEMICAL PRECIPITATION OF PHOSPHATE WITHIN A HIGH RATE BIO OXIDATION SYSTEM I. SYNTHETIC SEWAGE STUDIES,
W71-03900 05D

ECKENFELDER, WESLEY W.
ENGINEERING ASPECTS OF SURFACE AERATION DESIGN,
W71-04073 05D

EGUIAZAROV, I. V.
COMPUTATION OF MAXIMUM STORM DISCHARGE OF MOUNTAIN RIVERS,
W71-03982 02A

EHHALT, D. H.
STABLE ISOTOPES IN STUDY OF WATER BALANCE OF LAKE NEUSIEDL, AUSTRIA INVESTIGATION OF THE RELIABILITY OF THE STABLE ISOTOPE METHOD,
W71-04141 02A

EICHELBERGER, JAMES W.
PESTICIDES IN SURFACE WATERS OF THE UNITED STATES A FIVE-YEAR SUMMARY 1964-1968,
W71-04201 05A

EIDMAN, VERNON R.
USING COMPUTERS TO HELP EVALUATE FLOOD PROTECTION MEASURES,
W71-04293 07C

ALTERNATIVE CROP ENTERPRISE BUDGETS FOR IRRIGATED PRODUCTION, SOUTHWESTERN OKLAHOMA,
W71-04294 03F

EINSTEIN, HANS A.
SEDIMENT TRANSPORT IN DEGRADING RIVERS,
W71-03995 02J

EIPPER, ALFRED W.
POLLUTION PROBLEMS, RESOURCE POLICY AND THE SCIENTIST,
W71-04280 06B

EISEL, L. M.
COMMENTS ON 'THE LINEAR DECISION RULE IN RESERVOIR MANAGEMENT AND DECISION RULE IN RESERVOIR MANAGEMENT AND DESIGN' BY CHARLES REVELLE, ERHARD JOERES AND WILLIAM KIRBY,
W71-04029 06B

ELLIS, J. H.
THE DIFFUSION OF COPPER, MANGANESE, AND ZINC AS AFFECTED BY CONCENTRATION, CLAY MINERALOGY, AND ASSOCIATED ANIONS,
W71-03942 02G

ERICKSON, L. E.
MODELING AND OPTIMIZATION OF WATER RESOURCES SYSTEMS - PHASE I,
W71-04043 06A

ETTINGER, M. B.
BIODEGRADABILITY OF POTENTIAL ORGANIC SUBSTITUTES FOR PHOSPHATES,
W71-04072 05D

EVELYN, JOSEPH B.
HYDROGRAPH SYNTHESIS FOR WATERSHED SUBZONES FROM MEASURED URBAN PARAMETERS,
W71-04184 04C

FAIR, JOHN H.
WASTE PROBLEMS RELATIVE TO MINING AND MILLING OF MOLYBDENUM,
W71-03888 05D

FAN, L. T.
MODELING AND OPTIMIZATION OF WATER RESOURCES SYSTEMS - PHASE I,
W71-04043 06A

FARNSWORTH, CLAIR G.
STUDY OF MOLYBDENUM IN PUBLIC WATER SUPPLY,
W71-04120 05A

FEAD, W. N.
LITERATURE SURVEY OF MOISTURE MIGRATION IN SOILS DUE TO THERMAL GRADIENTS,
W71-04000 02C

FORD, DAVIS L.
ENGINEERING ASPECTS OF SURFACE AERATION DESIGN,
W71-04073 05D

FOX, IRVING K.
INSTITUTIONAL DESIGN FOR WATER QUALITY MANAGEMENT THE IMPLICATIONS OF A SYSTEMS APPROACH FOR LEGAL AND ADMINISTRATIVE ARRANGEMENTS,
W71-03867 06E

NEW HORIZONS IN WATER RESOURCES ADMINISTRATION,
W71-03887 06E

FOX, R. L.
SOLUBILITY AND AVAILABILITY OF SORBED SULFATE IN HAWAIIAN SOILS,
W71-03941 02G

FRANKEL, M.
LAW OF SEASHORE, WATERS AND WATERCOURSES OF MAINE AND MASSACHUSETTS,
W71-04257 04A

FREDRIK WULFF, BJORN GANNING, AND
A CHAMBER FOR OFFERING ALTERNATIVE CONDITIONS TO SMALL MOTILE AQUATIC ANIMALS,
W71-03853 05C

FREEMAN, A. MYRICK, III
BENEFIT-COST ANALYSIS AND MULTIPLE OBJECTIVES CURRENT ISSUES IN WATER RESOURCES PLANNING,
W71-04023 06C

FRISTOE, C. W.
STRUCTURE OF PUBLICLY-OWNED WATER UTILITIES,
W71-04281 06E

FULLER, WALLACE H.
MOVEMENT OF ALGAL- AND FUNGAL-BOUND RADIOSTRONTUM AS CHELATE COMPLEXES IN A CALCAREOUS SOIL,
W71-04067 05B

GAGOSHIDZE, M. S.
MUD FLOWS AND FLOODS AND THEIR CONTROL,
W71-03970 02J

GAILLARD, ROBERT J.
UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME I. STATE-OF-THE-ART OF OCEANOGRAPHIC AND METEOROLOGICAL SENSORS, TUTORIAL DISCUSSION,
W71-04009 07B

UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME II. STATE-OF-THE-ART OF OCEANOGRAPHIC AND METEOROLOGICAL SENSORS, CATALOG,
W71-04010 07B

GAN, T. L.
THE CIRCULATION PATTERN OVER SINGAPORE AND THE EAST COAST OF WEST MALAYSIA DURING JANUARY AND FEBRUARY 1967 COMPARED WITH THAT OF JANUARY AND FEBRUARY 1968,
W71-04170 02B

GARDNER, NOEL C.
ARTILLERY CONTROL OF AVALANCHES ALONG MOUNTAIN HIGHWAYS,
W71-04258 02C

GARRETT, W. D.
SURFACE CHEMISTRY STUDIES ON THE BAY OF PANAMA,
W71-04001 02L

GASSAWAY, JOHN D.
MINERAL AND CHEMICAL COMPOSITION OF SEDIMENTS FROM THE STRAITS OF FLORIDA,
W71-03944 02J

GATES, W. E.
APPLICATION OF INDUSTRIAL DYNAMICS CONCEPTS TO DECISION MAKING IN ENVIRONMENTAL MANAGEMENT,
W71-04025 05G

GAT, J. R.
ENVIRONMENTAL ISOTOPE BALANCE OF LAKE TIBERIAS,
W71-04140 02A

GAUDY, A. F., JR.
METABOLIC RESPONSE OF ACTIVATED SLUDGE TO SODIUM PENTACHLOROPHENOL,
W71-04088 05D

GINZBURG, TS. G.
CONCRETE FOR KRASNOLARSK DAM,
W71-04004 08F

GIRARD, C.
TOWARDS A BETTER USE OF THE OCEAN CONTEMPORARY LEGAL PROBLEMS IN OCEAN DEVELOPMENT,
W71-04338 06E

GLASSETT, JOSEPH M.
MINERAL RECOVERY FROM CONCENTRATED BRINES,
W71-04223 02K

GLASSNER, MARTIN I.
FEEDING A DESERT CITY ANTOFAGASTA, CHILE,
W71-04055 03F

GLENN, B. P.
A GUIDE TO USING INTEREST FACTORS IN ECONOMIC ANALYSIS OF WATER PROJECTS,
W71-04283 06B

GLOVER, ROBERT E.
THE PUMPED WELL,
W71-04292 04B

GODDARD, F. O.
STRUCTURE OF PUBLICLY-OWNED WATER UTILITIES,
W71-04281 06E

GOLUBTSOV, V. V.
HYDRAULIC RESISTANCE AND FORMULA FOR COMPUTING THE AVERAGE FLOW VELOCITY OF MOUNTAIN RIVERS,
W71-03961 02E

GOLZE, ALFRED R.
RECLAMATION IN THE UNITED STATES,
W71-04306 06C

GRANSEE, CHARLES L.
ENGINEERING EVALUATION OF FACTORS AFFECTING QUALITY OF WATER SOURCES AVAILABLE FOR SALINE WATER CONVERSION PLANTS,
W71-03916 03A

GRASNICK, H.
ESTIMATION OF THE WATER SUPPLY FROM SNOW COVER IN THE SOUTHERN PART OF THE GERMAN D. R. IN SPRING 1965,
W71-04180 02C

GREENSTEIN, STANLEY A.
ECONOMIC CONSIDERATIONS IN FACILITY PLANNING,
W71-04285 06B

GREER, ARTHUR J., JR.
THE IMPACT OF AGRICULTURAL CHANGE ON A LOCAL ECONOMY IN THE GREAT PLAINS,
W71-04289 03F

GRESSINGH, L. E.
DEVELOPMENT OF ECONOMICAL METHODS OF BORON REMOVAL FROM IRRIGATION RETURN WATERS,
W71-03914 05D

GRYANKO, L. P.
EXPERIMENTAL INVESTIGATIONS OF HYDRAULIC TURBINES WITH COMBINED RUNNERS,
W71-03998 08C

GUMMA, WILLIAM
UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME III. THE SURVIVAL ENVIRONMENT FOR OCEANOGRAPHIC AND METEOROLOGICAL SENSORS,
W71-04011 07B

GUPTA, D. K.
EVALUATION OF MAXIMUM RAINFALL DISCHARGE FROM A REGION OF DEFICIENT RAINFALL DATA,
W71-03978 02E

GUYMON, GARY LEROY
A SIMPLE CASCADE WATERSHED MODEL,
W71-04181 02A

GUYON, JOHN C.
SPECTROPHOTOMETRIC DETERMINATION OF CHLORATE ION,
W71-03994 02K

HAAS, HOWARD J.
AN ECONOMIC ANALYSIS OF LEVEL BENCH SYSTEMS FOR FORAGE PRODUCTION IN NORTH DAKOTA,
W71-04265 03F

HAGADORN, ROBERT E.
COMPUTER DESIGN OF SEWAGE TREATMENT PLANTS,
W71-03893 05D

HALEY, JAMES F.
MOLE DRAINAGE,
W71-04008 08A

HALL, RICHARD M.
FEDERAL ENFORCEMENT UNDER THE REFUSE ACT OF 1899,
W71-04102 06E

HALL, WARREN
WATER RESOURCES SYSTEMS ENGINEERING,
W71-03885 06A

HALL, WARREN A.
OPTIMAL ALLOCATION OF STOCHASTIC WATER SUPPLY,
W71-04028 03B

OPTIMUM FIRE POWER OUTPUT FROM A TWO RESERVOIR SYSTEM BY INCREMENTAL DYNAMIC PROGRAMMING,
W71-04111 04A

HAMER, WALTER J.
THEORETICAL MEAN ACTIVITY COEFFICIENTS OF STRONG ELECTROLYTES IN AQUEOUS SOLUTIONS FROM 0 TO 100 DEG C,
W71-04183 01B

HAMLIN, ROY M., JR.
STRUCTURE OF WATER IN MICROEMULSIONS ELECTRICAL, BIREFRINGENCE, AND NUCLEAR MAGNETIC RESONANCE STUDIES,
W71-04108 01B

HAMMOND, KENNETH A.
THE LAND AND WATER CONSERVATION FUND ACT DEVELOPMENT AND IMPACT,
W71-04097 06E

HANNA, G. P., JR.
RESPIRATORY RELATIONSHIPS OF A SYMBIOTIC ALGAL-BACTERIAL CULTURE FOR WASTE WATER NUTRIENT REMOVAL,
W71-04079 05D

HANNA, JOEL M.
RESPONSES OF NATIVE AND MIGRANT DESERT RESIDENTS TO ARID HEAT,
W71-04301 02I

HANSON, P. J.
TREATMENT OF ACID MINE DRAINAGE BY FOAM SEPARATION,
W71-04188 05D

HARBOE, RICARDO C.
OPTIMUM FIRE POWER OUTPUT FROM A TWO RESERVOIR SYSTEM BY INCREMENTAL DYNAMIC PROGRAMMING,
W71-04111 04A

HARDT, FREDERICK W.
SOLIDS SEPARATION BY ULTRAFILTRATION FOR CONCENTRATED ACTIVATED SLUDGE,
W71-04087 05D

HARRISON, C. H.
RECONSTRUCTION OF SUBGLACIAL RELIEF FROM RADIO ECHO SOUNDING RECORDS,
W71-04112 02C

HART, ROGER
CHEMICAL EXCHANGE BETWEEN SEA WATER AND DEEP OCEAN BASALTS,
W71-03956 02K

HASAN, S. M.
SOLUBILITY AND AVAILABILITY OF SORBED SULFATE IN HAWAIIAN SOILS,
W71-03941 02G

HATCHER, J. T.
ADSORPTION OF BORON BY FERROMAGNESIAN MINERALS AND MAGNESIUM HYDROXIDE,
W71-03939 02G

HAUPT, HAROLD F.
VERIFYING RECORDING PRECIPITATION GAUGE RECORDS,
W71-04264 07C

HAVELKA, J.
THE EFFECT OF SOME SOLVENTS ON LOWER WATER ANIMALS AND ON FISHES,
W71-03854 05C

HAVEMAN, ROBERT H.
BENEFIT-COST ANALYSIS AND MULTIPLE OBJECTIVES CURRENT ISSUES IN WATER RESOURCES PLANNING,
W71-04023 06C

HAZAN, R.
DETERMINATION OF MAXIMUM FLOW AND FLOOD HYDROGRAPHS (FRENCH),
W71-03985 02E

HEGEDUS, M.

SOME PROBLEMS OF DETERMINING THE WATER EQUIVALENT OF THE SNOW COVER,
W71-04173 02C

HEIDMAN, J. A.
METABOLIC RESPONSE OF ACTIVATED SLUDGE TO SODIUM PENTACHLOROPHENOL,
W71-04088 05D

HEINTZ, JOHN W.
ENGINEERING EVALUATION OF FACTORS AFFECTING QUALITY OF WATER SOURCES AVAILABLE FOR SALINE WATER CONVERSION PLANTS,
W71-03916 03A

HELDEBRANDT, KENNETH I.
UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME I. STATE-OF-THE-ART OF OCEANOGRAPHIC AND METEOROLOGICAL SENSORS, TUTORIAL DISCUSSION,
W71-04009 07B

UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME II. STATE-OF-THE-ART OF OCEANOGRAPHIC AND METEOROLOGICAL SENSORS, CATALOG,
W71-04010 07B

HELLIWELL, N. C.
THE CALCULATION OF RAINFALL FROM A HURRICANE,
W71-03993 02B

HENDRICKS, ERNEST L.
AN OVERVIEW OF U.S. DEPARTMENT OF INTERIOR'S ROLE IN SEDIMENT CONTROL,
W71-04147 04D

HERAS, R.
PRACTICAL METHODS OF ESTIMATING MAXIMUM FLOODS (FRENCH),
W71-03990 02E

HERR, LESTER A.
THE CONTROL OF EROSION AND SEDIMENT IN HIGHWAY CONSTRUCTION,
W71-04149 04D

HICKS, JON D.
OPTIMIZATION FOR PLANNING AND LOCATION OF PRECIPITATION STATIONS IN THE JEMEZ MOUNTAINS,
W71-04033 06A

HILGEMAN, R. H.
ROOTSTOCKS FOR VALENCIA ORANGES AND LISBON LEMONS IN ARIZONA,
W71-04059 03F

HILL, RALPH D., JR.
BEDLOAD FORMULAS. PART A. A SELECTION OF BEDLOAD FORMULAS. PART B. PROGRAM LISTINGS FOR BEDLOAD FORMULAS,
W71-03999 02E

HILL, RONALD D.
NEUTRALIZATION OF HIGH FERRIC IRON ACID MINE DRAINAGE,
W71-04189 05D

HINE, R. B.
ELEVATION AND TEMPERATURE EFFECTS ON SEVERITY OF MAIZE DWARF MOSAIC VIRUS IN SORGHUM,
W71-04060 03F

HOFFMAN, C. E.
INFLUENCE OF TEMPERATURE AND PHOTOPERIOD ON GROWTH, FOOD CONSUMPTION AND FOOD CONVERSION EFFICIENCY OF CHANNEL CATFISH,
W71-03920 05C

HOLE, F. D.
MINERALOGY OF SOME ARID AND SEMIARID LAND SOILS OF IRAQ,
W71-04061 02G

HOLLEY, W. H.
POROUS TUBULET SUPPORTS FOR DESALINATION BARRIERS,
W71-03911 03A

HOLT, ROBERT F.
ACCUMULATION OF PHOSPHATES IN WATER,
W71-04216 05B

HOPKINS, CHARLES O.
ALTERNATIVE CROP ENTERPRISE BUDGETS FOR IRRIGATED PRODUCTION, SOUTHWESTERN OKLAHOMA,
W71-04294 03F

HORTON, FRANK E.
SPATIAL PATTERNS OF SOCIO-ECONOMIC STRUCTURE IN INDIA,
W71-04234 06B

HOUSER, E. W.
SANTEE PROJECT CONTINUES TO SHOW THE WAY,
W71-03904 05D

HOWELLS, DAVID H.
ANNUAL REPORT, JULY 1, 1969-JUNE 30, 1970,
W71-03921 09A

HOWELL, DAVID T.
OPTIMAL ALLOCATION OF STOCHASTIC WATER SUPPLY,
W71-04028 03B

HUBER, W. C.
PREDICTION OF SOLAR AND ATMOSPHERIC RADIATION FOR ENERGY BUDGET STUDIES OF LAKES AND STREAMS,
W71-04020 02B

HUFSCHMIDT, MAYNARD M.
WATER RESOURCES PLANNING IN THE URBAN-METROPOLITAN CONTEXT,
W71-03861 06B

HUMENIK, F. J.
RESPIRATORY RELATIONSHIPS OF A SYMBIOTIC ALGAL-BACTERIAL CULTURE FOR WASTE WATER NUTRIENT REMOVAL,
W71-04079 05D

HUQ, M. S.
HEAVY RAINFALL IN PAKISTAN AND ITS ASSOCIATED FLOOD,
W71-04168 02B

HUSTON, RIMA
THE USE OF AMALGAM ELECTRODES TO MEASURE ACTIVITY COEFFICIENTS IN MULTICOMPONENT SALT SOLUTIONS,
W71-04221 01B

HUSZAR, PAUL C.
EVALUATION OF IRRIGATION WATER AND NITROGEN FERTILIZER IN CORN PRODUCTION,
W71-04304 03F

HUTCHINSON, PETER
A CONTRIBUTION TO THE PROBLEM OF SPACING RAINGAUGES IN RUGGED TERRAIN,
W71-04122 07A

HWANG, IRVING
STREAM QUALITY MODELING BY QUASILINEARIZATION,
W71-04045 05F

INDERBITZEN, A. L.
EMPIRICAL RELATIONSHIPS BETWEEN MASS PHYSICAL PROPERTIES FOR RECENT MARINE SEDIMENTS OFF SOUTHERN CALIFORNIA,
W71-03951 02J

INGVALSON, R. D.
ADSORPTION OF BORON BY FERROMAGNESIAN MINERALS AND MAGNESIUM HYDROXIDE,
W71-03939 02G

ISHIHARA, KENJI
PREDICTION OF FLOODS FROM HEAVY RAINFALL,
W71-04159 02E

ISHIZUKA, K.
ANALYSIS OF SNOW MELT FLOODS,
W71-04179 02E

ISRAELSEN, EUGENE K.
HYDROGRAPH SYNTHESIS FOR WATERSHED SUBZONES FROM MEASURED URBAN PARAMETERS,
W71-04184 04C

IVANOV, I. V.
PATTERN OF VARIATION OF THE LENGTH OF FREELY MEANDERING RIVERS,
W71-03969 02J

JACKSON, M. L.
MINERALOGY OF SOME ARID AND SEMIARID LAND SOILS OF IRAQ,
W71-04061 02G

JACQUET, J.
DETERMINATION OF MAXIMUM FLOOD FLOW AND THE PROBABILITY OF ITS BEING EXCEEDED, USING INCOMPLETE INFORMATION (FRENCH),
W71-03979 02E

JAMES, L. DOUGLAS
INCORPORATING SOCIAL OBJECTIVES IN SYSTEMS MODELS,
W71-03862 06B

JARVIS, N. L.
SURFACE CHEMISTRY STUDIES ON THE BAY OF PANAMA,
W71-04001 02L

JENKINS, CHARLES R.
MINE ACID DRAINAGE AND ASSOCIATED FLOW FLUCTUATIONS,
W71-03938 05B

JENNINGS, ROBERT
A CASE STUDY OF MICROORGANIC CONTAMINANTS IN RIVER WATER,
W71-04119 05A

JOERES, E.
REPLY,
W71-04035 06B

JOHNSON, ALFRED M. F.
WATER USE IN TENNESSEE, PART D - SUMMARY,
W71-04324 06D

JOHNSON, LOYAL A.
INVESTIGATION OF AIRFIELD DRAINAGE ARCTIC AND SUBARCTIC REGIONS, SUPPLEMENT TO PART I, FIELD RECONNAISSANCE AND ANALYSIS,
W71-04002 04A

JOHNSON, WILLIAM C.
ARTIFICIAL SUBSTRATE SAMPLING, MACROINVERTEBRATES IN A POLLUTED REACH OF THE KLAMATH RIVER, OREGON,
W71-04191 05A

JOHNSTON, ROBERT S.
ASPEN SPROUT PRODUCTION AND WATER USE,
W71-04241 02I

SOIL MOISTURE DEPLETION AND ESTIMATED EVAPOTRANSPIRATION ON UTAH MOUNTAIN WATERSHED,
W71-04242 02D

JONES, THOMAS A.
COMPARISON OF THE DESCRIPTORS OF SEDIMENT GRAIN-SIZE DISTRIBUTIONS,
W71-03947 02J

JORDAN, GILBERT L.
THE SAM SIMON WATERSHED SHRUB CONTROL,
W71-04058 03F

JUDSON, ARTHUR
ARTILLERY CONTROL OF AVALANCHES ALONG MOUNTAIN HIGHWAYS,
W71-04258 02C

KALTER, ROBERT J.
THE ROLE OF ECONOMIC EVALUATION IN GOVERNMENTAL ANALYSIS,
W71-04272 06B

KAMALOV, B. A.
COMPUTATION OF FLOW IN GLACIER-FED RIVERS,
W71-03975 02E

KAPOTOV, A. A.
INVESTIGATION OF THE WATER REGIME OF SOILS IN THE AERATION ZONE, THEIR FREEZING, WATER-PHYSICAL AND FILTRATION PROPERTIES,
W71-03964 02G

KARABENICK, EDWARD
IRRIGATION DEVELOPMENT IN TUNISIA,
W71-04232 03F

KARASEV, I. F.
INFLUENCE OF THE BANKS AND FLOOD PLAIN ON CHANNEL CONVEYANCE,
W71-03968 02E

KARELIOTIS, S. J.
ANALYSIS OF STOCHASTIC HYDROLOGIC SYSTEMS,
W71-03869 02A

KATES, ROBERT W.
NATURAL HAZARD IN HUMAN ECOLOGICAL PERSPECTIVE HYPOTHESES AND MODELS,
W71-04032 06G

KAUTH, R.
ESTIMATION OF SEA SURFACE TEMPERATURE FROM SPACE,
W71-03959 07B

KAWAHARA, FRED K.
LABORATORY GUIDE FOR THE IDENTIFICATION ON PETROLEUM PRODUCTS,
W71-04199 05A

MICRODETERMINATION OF DERIVATIVES OF PHENOLS AND MERCAPTANS BY MEANS OF ELECTRON CAPTURE GAS CHROMATOGRAPHY,
W71-04218 05A

KEDEM, O.
WATER TRANSPORT THROUGH PLASTICIZED MEMBRANES,
W71-03912 03A

KELLER, HANS M.
MEASURING STREAM DISCHARGE USING THE DYE-DILUTION METHOD (CHEMICAL GAUGING),
W71-03930 07B

KELLOW, RICHARD L.
A STUDY OF WATER USE IN SINGLE-DWELLING RESIDENCES IN THE CITY OF CALGARY, ALBERTA, ALBERTA UNIV., EDMONTON (CANADA),
W71-04287 03D

KELSO, MAURICE M.
COMPETITION FOR WATER IN AN EXPANDING ECONOMY POLICIES AND INSTITUTIONS,
W71-04268 06E

KEMPER, W. D.
IMPROVING EFFICIENCY IN AGRICULTURAL WATER USE,
W71-04049 03C

KEM, JAN A.
THE EFFECT OF SHORT-TERM TEMPERATURE VARIATIONS ON METHANE PRODUCTION,
W71-04077 05D

KEPLER, JACK E.
NATURE'S LAW AND MAN'S ETHIC,
W71-04069 04C

KERWIN, JEROME G.
FEDERAL WATER-POWER LEGISLATION,
W71-04307 06E

KEYS, K. M.
A RAPID METHOD OF COMPUTING AREAL RAINFALL,
W71-04123 07B

KILAMBI, R. V.
INFLUENCE OF TEMPERATURE AND PHOTOPERIOD ON GROWTH, FOOD CONSUMPTION AND FOOD CONVERSION EFFICIENCY OF CHANNEL CATFISH,
W71-03920 05C

KILGORE, WENDELL W.
GAS CHROMATOGRAPHIC SEPARATIONS OF MIXED CHLORINATED FUNGICIDES,
W71-04213 05A

KIMBLER, OSCAR K.
EFFECT OF DISPERSION, GRAVITATIONAL SEGREGATION, AND FORMATION STRATIFICATION ON THE RECOVERY OF FRESHWATER STORED IN SALINE AQUIFERS,
W71-03870 02F

KINCANNON, D. F.
METABOLIC RESPONSE OF ACTIVATED SLUDGE TO SODIUM PENTACHLOROPHENOL,
W71-04088 05D

KINOSITA, T.
ANALYSIS OF SNOW MELT FLOODS,
W71-04179 02E

KIRBY, W.
REPLY,
W71-04035 06B

KLEIN, GEORGE DEVRIES
DEPOSITIONAL AND DISPERSAL DYNAMICS OF INTERTIDAL SAND BARS,
W71-03948 02J

KLINGEMAN, PETER C.
THE INFLUENCE OF LANDFORM AND PRECIPITATION PARAMETERS ON FLOOD HYDROGRAPHS,
W71-03871 02E

KNOWLES, G.
MATHEMATICAL MODELS AS AN AID IN THE SOLUTION OF WATER POLLUTION CONTROL PROBLEMS,
W71-03884 05G

KOLODIN, M. V.
PROGRESS IN WATER DESALINATION TECHNOLOGY,
W71-04229 03A

KONDITEROVA, E. A.
PATTERN OF VARIATION OF THE LENGTH OF FREELY MEANDERING RIVERS,
W71-03969 02J

KONOVALOV, V. G.
PROBLEM OF THE CLASSIFICATION AND SPATIAL VARIABILITY OF THE ALBEDO OF A HOMOGENEOUS GLACIER SURFACE DURING THE ABLATION PERIOD,
W71-03971 02C

KOPP, JOHN F.
A DIRECT-READING SPECTROCHEMICAL PROCEDURE FOR THE MEASUREMENT OF NINETEEN MINOR ELEMENTS IN NATURAL WATER,
W71-04211 05A

KORMANIK, RICHARD A.
DESIGN OF PLUGFLOW POST AERATION BASIN,
W71-03889 05D

KORNEGAY, B. H.
KINETICS OF FIXED FILM BIOLOGICAL REACTORS,
W71-04085 05D

KOVZEL, A. G.
A METHOD FOR THE COMPUTATION OF WATER YIELD FROM SNOW DURING SNOWMELT PERIOD,
W71-04172 02C

KREIS, R. DOUGLAS
ARTIFICIAL SUBSTRATE SAMPLING, MACROINVERTEBRATES IN A POLLUTED REACH OF THE KLAMATH RIVER, OREGON,
W71-04191 05A

KRIVONOSOV, I. M.
DRAINAGE LINE DEPTH,
W71-04016 08D

KRONER, ROBERT C.
A DIRECT-READING SPECTROCHEMICAL PROCEDURE FOR THE MEASUREMENT OF NINETEEN MINOR ELEMENTS IN NATURAL WATER,
W71-04211 05A

KUCHMENT, L. S.
CALCULATION OF FLOOD WAVES FOR A LARGE RIVER SYSTEM,
W71-04176 02E

KUDOYAROV, L. I.
SARATOV HYDROELECTRIC POWERPLANT CONSTRUCTION DATA,
W71-04017 08C

KUMAR, ANIL
EFFECT OF DISPERSION, GRAVITATIONAL SEGREGATION, AND FORMATION STRATIFICATION ON THE RECOVERY OF FRESHWATER STORED IN SALINE AQUIFERS,
W71-03870 02F

KUMAR, J.
NEW CHART OFFERS FAST PERMEABILITY ESTIMATE,
W71-04110 07B

KUZMIN, P. P.
SNOWMELT AND WATER YIELD FROM SNOW COVER,
W71-04171 02C

KYI, BA
LOWER AND MIDDLE IRRAWADDY FLOODS IN RELATION TO HEAVY RAINFALL IN THE HEAD WATER REGIONS OF CHINDWIN AND IRRAWADDY RIVERS,
W71-04165 02E

LACEWELL, RONALD D.
USING COMPUTERS TO HELP EVALUATE FLOOD PROTECTION MEASURES,
W71-04293 07C

LAKSHMANA RAO, N. S.

THE UNIVERSALISATION OF THE CO-ORDINATES OF LOGARITHMIC WEIR PROFILES,
W71-04127 07B

EXPERIMENTAL STUDIES ON LINEAR PROPORTIONAL WEIRS WITH TRIANGULAR BOTTOMS,
W71-04129 08B

LATTERELL, JOSEPH J.
ACCUMULATION OF PHOSPHATES IN WATER,
W71-04216 05B

LAYCOCK, W. A.
WATERSHED MANAGEMENT IN THE UNITED STATES CONCEPTS AND PRINCIPLES,
W71-04253 03B

LAZAREVIC, D.
DETERMINATION OF MAXIMUM FLOW AND FLOOD HYDROGRAPHS (FRENCH),
W71-03985 02E

LEENDERTSE, J. J.
A WATER-QUALITY SIMULATION MODEL FOR WELL-MIXED ESTUARIES AND COASTAL SEAS VOLUME I, PRINCIPLES OF COMPUTATION,
W71-04038 06A

LEE, DAVID R.
THE LOCATION OF LAND USE TYPES THE NILE VALLEY IN NORTHERN SUDAN,
W71-04228 04A

LEE, E. S.
APPLYING GRADIENT PROJECTION AND CONJUGATE GRADIENT TO THE OPTIMUM OPERATION OF RESERVOIRS,
W71-04030 04A

A NONLINEAR MULTIPLE RESERVOIR WATER RESOURCES MODEL WITH MULTIPLE PURPOSES,
W71-04044 04A

STREAM QUALITY MODELING BY QUASILINEARIZATION,
W71-04045 05F

OPTIMUM OPERATION OF MULTIPLE RESERVOIRS WITH MULTIPLE PURPOSES,
W71-04046 04A

OPTIMIZATION OF WATER RESOURCES SYSTEMS BY THE GRADIENT PROJECTION METHOD,
W71-04047 06A

LEE, F. S.
MODELING AND OPTIMIZATION OF WATER RESOURCES SYSTEMS - PHASE I,
W71-04043 06A

LEGRAND, HARRY E.
MOVEMENT OF AGRICULTURAL POLLUTANTS WITH GROUNDWATER,
W71-04121 05B

LEIDNER, R. N.
WASTE WATER TREATMENT FACILITIES AT BURNS HARBOR,
W71-04080 05D

LENNOX, D. H.
GEOHYDROLOGIC BOUNDARY ENVELOPES,
W71-04125 02F

LEWIS, PHILIP A.
REARING DEVICES FOR STREAM INSECT LARVAE,
W71-04190 07B

USING MACROINVERTEBRATE COLLECTIONS FOR WATER QUALITY MONITORING IN THE OHIO RIVER BASIN 1963-1966,
W71-04208 05C

LICHTENBERG, JAMES J.
PESTICIDES IN SURFACE WATERS OF THE UNITED STATES A FIVE-YEAR SUMMARY 1964-1968,
W71-04201 05A

LITOSH, V. A.
SOME FEATURES OF THE MECHANICS OF GLACIER MOVEMENT,
W71-03972 02C

LIVERMORE, THOMAS R.
UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME III. THE SURVIVAL ENVIRONMENT FOR OCEANOGRAPHIC AND METEOROLOGICAL SENSORS,
W71-04011 07B

UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME VI. TEST REQUIREMENTS FOR OCEANOGRAPHIC AND METEOROLOGICAL SENSORS,
W71-04014 07B

LIVINGSTON, R. B.
THE ROLE OF AQUATIC VASCULAR PLANTS IN THE EUTROPHICATION OF SELECTED LAKES IN WASTERN MASSACHUSETTS,
W71-03918 05C

LOBRING, L. B.
EVALUATION REPORT 1 AUTOMATIC BEAKER SAMPLE CHANGER,
W71-04192 07B

LOF, GEORGE O. G.
ECONOMICS OF THERMAL POLLUTION CONTROL,
W71-04084 05D

LONGBOTTOM, JAMES E.
PESTICIDES IN SURFACE WATERS OF THE UNITED STATES A FIVE-YEAR SUMMARY 1964-1968,
W71-04201 05A

LORENZ, WALTER C.
A REVIEW OF CURRENT RESEARCH ON COAL MINE DRAINAGE IN APPALACHIA,
W71-03874 05B

FACTORS THAT AFFECT THE FORMATION OF COAL MINE DRAINAGE POLLUTION IN APPALACHIA,
W71-03875 05B

THE OXIDATION OF PYRITE ASSOCIATED WITH COAL MINES,
W71-03876 05B

SURVEY OF COSTS ON METHODS FOR CONTROL OF ACID MINE DRAINAGE POLLUTION,
W71-03877 05B

LOUCKS, DANIEL P.
A REVIEW OF THE 1969 LITERATURE ON WASTE WATER AND WATER POLLUTION CONTROL, ADMINISTRATION SYSTEMS ANALYSIS,
W71-03879 05G

LOVE, S.
BIOLOGICAL CHEMICAL COMBINATION DRAMATICALLY CUTS TREATMENT,
W71-04086 05D

LOW, RICHARD D. H.
A MORE RIGOROUS EXPRESSION FOR THE RATE OF DROPLET GROWTH,
W71-04005 03B

LUDWICK, JOHN C.
SAND WAVES AND TIDAL CHANNELS IN THE ENTRANCE TO CHESAPEAKE BAY,
W71-03958 02L

LUDWIG, HARVEY F.
EFFECTS OF WASTE DISPOSAL INTO MARINE WATERS - A SURVEY OF STUDIES CARRIED OUT IN THE LAST TEN YEARS,
W71-04114 05C

LUGAR, MARLYN E.
WATER RIGHTS LAW AND MANAGEMENT IN WEST VIRGINIA -- FUTURE NEEDS AND ALTERNATIVES,
W71-03880 06E

LUNSFORD, J. V.
OPTIMIZATION FOR PLANNING AND LOCATION OF PRECIPITATION STATIONS IN THE JEMEZ MOUNTAINS,
W71-04033 06A

LYON, GALE H.
ECONOMIC ANALYSIS OF MARINAS IN MARYLAND,
W71-04267 06D

L'ANNUNZIATA, MICHAEL F.
MOVEMENT OF ALGAL- AND FUNGAL-BOUND RADIOSTRONTUM AS CHELATE COMPLEXES IN A CALCAREOUS SOIL,
W71-04067 05B

MACDONALD, FRANK H.
UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME III. THE SURVIVAL ENVIRONMENT FOR OCEANOGRAPHIC AND METEOROLOGICAL SENSORS,
W71-04011 07B

UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME VI. TEST REQUIREMENTS FOR OCEANOGRAPHIC AND METEOROLOGICAL SENSORS,
W71-04014 07B

MADISON, R. J.
WATER-QUALITY DATA FOR THE FLAMING GORGE RESERVOIR AREA, UTAH AND WYOMING,
W71-03936 07C

MAKARYCHEVA, E. A.
DETERMINATION OF SOIL PERMEABILITY BY THE METHOD OF LARGE RINGS,
W71-04006 02G

MALES, R. M.
APPLICATION OF INDUSTRIAL DYNAMICS CONCEPTS TO DECISION MAKING IN ENVIRONMENTAL MANAGEMENT,
W71-04025 05G

MALMSTROM, VINCENT H.
A NEW APPROACH TO THE CLASSIFICATION OF CLIMATE,
W71-04235 02B

MALONEY, FRANK E.
WATER QUALITY CONTROL A MODERN APPROACH TO STATE REGULATION,
W71-04101 06E

MALONE, P. G.
MICROBIAL CARBONATE AND PHOSPHATE PRECIPITATES FROM SEA WATER CULTURES,
W71-03950 02K

MANEVAL, DAVID R.
MINE WASTE WATER PROBLEMS IN EUROPE,
W71-03898 05D

MANHEIM, F. T.
THE DIFFUSION OF IONS IN UNCONSOLIDATED SEDIMENTS,
W71-03954 02K

MANN, FRED L.

WATER-USE LAW IN MISSOURI,
W71-04339 06E

MANTAN, D. C.
DETERMINATION OF THE DISTRIBUTION OF RAINFALL FLOODS IN LARGE CATCHMENTS USING HYDROMETEOROLOGICAL DATA,
W71-03977 02E

MARKER, MARGARET E.
SOME PROBLEMS OF A KARST AREA IN THE EASTERN TRANSVAAL, SOUTH AFRICA,
W71-04053 02G

MARLETTE, RALPH R.
UTILIZATION OF THE STORAGE POTENTIAL OF RIVER VALLEY AQUIFERS,
W71-03924 02F

MARTENS, H. H.
ARSENIC IN POTABLE DESERT GROUNDWATER AN ANALYSIS PROBLEM,
W71-04109 02K

MARTINEC, J.
VARIATION OF THE TRITIUM AND OXYGEN-18 CONTENT IN PRECIPITATION AND SNOWPACK IN A REPRESENTATIVE BASIN IN CZECHOSLOVAKIA,
W71-04135 02A

MASON, WILLIAM T.
A LIMESTONE-FILLED, ARTIFICIAL SUBSTRATE SAMPLER-FLOAT UNIT FOR COLLECTING MACROINVERTEBRATES IN LARGE STREAMS,
W71-04219 07B

MASON, WILLIAM T., JR.
REARING DEVICES FOR STREAM INSECT LARVAE,
W71-04190 07B

ARTIFICIAL SUBSTRATE SAMPLING, MACROINVERTEBRATES IN A POLLUTED REACH OF THE KLAMATH RIVER, OREGON,
W71-04191 05A

USING MACROINVERTEBRATE COLLECTIONS FOR WATER QUALITY MONITORING IN THE OHIO RIVER BASIN 1963-1966,
W71-04208 05C

MATLOCK, W. G.
COMPUTER AIDS GROUNDWATER RESOURCES RESEARCH PROJECT,
W71-04057 02F

MATTA, G. A.
SECOND REPORT ON HORIZONTAL-TUBE MULTIPLE-EFFECT PROCESS PILOT PLANT TESTS AND DESIGN,
W71-04220 03A

MATTHEWS, WILLIAM B., JR.
ECONOMIC ANALYSIS OF MARINAS IN MARYLAND,
W71-04267 06D

MAYNARD, MICHAEL L.
THE SAM SIMON WATERSHED SHRUB CONTROL,
W71-04058 03F

MAYURKIEWICZ, MICHAEL A.
WATER QUALITY - BENTHIC INVERTEBRATE RELATIONSHIPS IN ESTUARIES,
W71-03922 05C

MCCALLA, T. M.
MICROBIAL POPULATIONS IN STUBBLE-MULCHED SOIL,
W71-04068 02G

MCCARTY, PERRY L.
THE ANAEROBIC FILTER FOR WASTE TREATMENT,
W71-04075 05D

MCCONNELL, HAROLD
SPATIAL PATTERNS OF SOCIO-ECONOMIC STRUCTURE IN INDIA,
W71-04234 06B

MCFARLAND, BEN H.
PERIPHYTON BIOMASS-CHLOROPHYLL RATIO AS AN INDEX OF WATER QUALITY,
W71-04206 05A

MCLARNEY, JAMES
WATER-USE LAW IN MISSOURI,
W71-04339 06E

MCMARTIN, WALLACE
AN ECONOMIC ANALYSIS OF LEVEL BENCH SYSTEMS FOR FORAGE PRODUCTION IN NORTH DAKOTA,
W71-04265 03F

MEEUWIG, R. O.
INFILTRATION AND SOIL EROSION AS INFLUENCED BY VEGETATION AND SOIL IN NORTHERN UTAH,
W71-04260 02J

INFILTRATION AND SOIL EROSION ON COOLWATER RIDGE, IDAHO,
W71-04261 02J

MERLIVAT, LILIANE
QUANTITATIVE ASPECTS OF THE STUDY OF WATER BALANCES IN LAKES USING THE DEUTERIUM AND OXYGEN-18 CONCENTRATIONS IN THE WATER, (FRENCH),
W71-04139 02A

MERRITT, W. F.
PERCH LAKE EVAPORATION STUDY,
W71-04142 02A

MIDGETT, M. R.
FWPCA METHOD STUDY 1 MINERAL AND PHYSICAL ANALYSES - AN EVALUATION OF FWPCA ANALYTICAL METHODS FOR SURFACE WATERS,
W71-04200 05A

MIESSLER, GARY L.
A MULTI-PHASIC COMPONENT STUDY TO PREDICT STORM WATER POLLUTION FROM URBAN AREAS,
W71-03917 05C

MILLER, DON E.
GEOLOGY AND GROUNDWATER RESOURCES OF ALLEN COUNTY, KANSAS,
W71-03937 02F

MILLER, FRANK
WATER-USE LAW IN MISSOURI,
W71-04339 06E

MILLIGAN, W. O.
THE STRUCTURE AND MORPHOLOGY OF INORGANIC MEMBRANES,
W71-04224 03A

MILLS, HENRY J.
BOLSA ISLAND NUCLEAR POWER AND DESALTING PROJECT FACILITIES (COST AND DESCRIPTION) AND COST OF DESALTED WATER,
W71-03915 03A

MILSTEAD, C. E.
MEMBRANE MATERIALS FOR WASTE WATER RECLAMATION BY REVERSE OSMOSIS,
W71-04185 05D

MITCHELL, BRUCE
THE INSTITUTIONAL FRAMEWORK FOR WATER MANAGEMENT IN ENGLAND AND WALES,
W71-04282 06E

MITCHUM, DOUGLAS L.
STUDY OF WATER POLLUTION PROBLEMS WHICH AFFECT FISH AND OTHER AQUATIC FORMS,
W71-03852 05C

MOAZZAM, SUFI M.
HEAVY RAINFALL AND ASSOCIATED FLOODS IN WEST PAKISTAN,
W71-04169 02B

MOKLYAK, V. I.
WATER DISCHARGE TRAVEL TIME COEFFICIENTS,
W71-03973 02E

MOORE, BRUCE R.
A GEOCHEMICAL TREND IN SILICON-ALUMINUM-IRON RATIOS AND THE CLASSIFICATION OF CLASTIC SEDIMENTS,
W71-03945 02K

MOORE, DONALD R.
PHYTOPLANKTON, SESTON, AND DISSOLVED ORGANIC CARBON IN THE LITTLE MIAMI RIVER AT CINCINNATI, OHIO,
W71-04209 05A

MOORE, TOM D.
STUDY OF WATER POLLUTION PROBLEMS WHICH AFFECT FISH AND OTHER AQUATIC FORMS,
W71-03852 05C

MOREAU, DAVID H.
SUPERPOSITION OF SUBMONTHLY FLOWS IN STOCHASTIC HYDROLOGY,
W71-04040 02E

MORGAN, W. B.
FARMING, FOREST AND SAVANNA IN WESTERN NIGERIA,
W71-04054 03F

MORRISON, GEORGE E.
A LIMESTONE-FILLED, ARTIFICIAL SUBSTRATE SAMPLER-FLOAT UNIT FOR COLLECTING MACROINVERTEBRATES IN LARGE STREAMS,
W71-04219 07B

MOSER, H.
DEUTERIUM MEASUREMENTS ON SNOW SAMPLES FROM THE ALPS,
W71-04136 02A

MOSS, R. P.
FARMING, FOREST AND SAVANNA IN WESTERN NIGERIA,
W71-04054 03F

MOTTS, WARD S.
OPTIMUM UTILIZATION AND MANAGEMENT OF WATER BEARING FORMATIONS HYDRAULICALLY CONNECTED TO A STRETCH OF THE CONNECTICUT RIVER,
W71-03919 04B

MURALIDHAR, D.
THE TRAPEZOIDAL FREE OVERFALL,
W71-04128 08B

MUSKIE, EDMUND S.
ENVIRONMENTAL JURISDICTION IN THE CONGRESS AND THE EXECUTIVE,
W71-04106 06E

MYERS, D. A.
AVAILABILITY OF GROUNDWATER IN WESTERN COWLITZ COUNTY, WASHINGTON,
W71-03934 02F

MYSHKIN, V. T.
RADIOMETRIC INVESTIGATIONS ON THE BEACH AT THE MOUTH OF THE KURA RIVER,
W71-03962 02J

NANDA, VED P.
OFFSHORE OIL SPILLS AN EVALUATION OF RECENT UNITED STATES RESPONSES,
W71-04305 06E

NARAYANA, V. V.
HYDROGRAPH SYNTHESIS FOR WATERSHED SUBZONES FROM MEASURED URBAN PARAMETERS,
W71-04184 04C

NAUMAN, JON W.
COST OF PATUXENT RIVER QUALITY MONITORING,
W71-04115 05A

NEAS, ROBERT E.
SPECTROPHOTOMETRIC DETERMINATION OF THIOCYANATE AND OXALATE,
W71-03928 05A

NEBOLSINE, R.
WASTE WATER TREATMENT FACILITIES AT BURNS HARBOR,
W71-04080 05D

NECHAEVA, N. S.
CALCULATION OF FLOOD WAVES FOR A LARGE RIVER SYSTEM,
W71-04176 02E

NEMEROW, NELSON L.
SOLIDS SEPARATION BY ULTRAFILTRATION FOR CONCENTRATED ACTIVATED SLUDGE,
W71-04087 05D

NEMEROW, N. L.
PROTOTYPE STUDIES OF COMBINED TREATMENT OF WASTES FROM 22 TANNERIES AND TWO MUNICIPALITIES,
W71-03892 05D

NESBITT, J. B.
CHEMICAL PRECIPITATION OF PHOSPHATE WITHIN A HIGH RATE BIO OXIDATION SYSTEM I. SYNTHETIC SEWAGE STUDIES,
W71-03900 05D

NOBLE, J.
INFLUENCE OF TEMPERATURE AND PHOTOPERIOD ON GROWTH, FOOD CONSUMPTION AND FOOD CONVERSION EFFICIENCY OF CHANNEL CATFISH,
W71-03920 05C

NORSTADT, FRED A.
MICROBIAL POPULATIONS IN STUBBLE-MULCHED SOIL,
W71-04068 02G

NORSWORTHY, J. R.
THE EVALUATION OF THE COST OF ALTERNATIVE STRATEGIES FOR AIR POLLUTION CONTROL,
W71-03859 06A

OJO, OYEDIRAN
POTENTIAL EVAPOTRANSPIRATION AND THE WATER BALANCE IN WEST AFRICA AN ALTERNATIVE METHOD OF PENMAN,
W71-04063 02D

OLIVER, J.
PROBLEMS OF DETERMINING EVAPOTRANSPIRATION IN THE SEMI-ARID TROPICS ILLUSTRATED WITH REFERENCE TO THE SUDAN,
W71-04236 02D

OLSON, CARL E.
IRRIGATION AS A FARM GROWTH STRATEGY,
W71-04290 03F

ORME, ANTONY R.
THE EFFECT OF VEGETATION CONVERSION AND FLOOD DISCHARGE ON STREAM CHANNEL GEOMETRY THE CASE OF SOUTHERN CALIFORNIA WATERSHEDS,
W71-04230 04D

OSBORNE, W. E.
ELEVATION AND TEMPERATURE EFFECTS ON SEVERITY OF MAIZE DWARF MOSAIC VIRUS IN SORGHUM,
W71-04060 03F

OSBORN, JOSEPH F.
WETTING AGENT FAILS TO CURB EROSION FROM BURNED WATERSHED,
W71-04250 04D

OSTERBERG, J. O.
LITERATURE SURVEY OF MOISTURE MIGRATION IN SOILS DUE TO THERMAL GRADIENTS,
W71-04000 02C

OSTROM, ELINOR
CONDITIONS OF LEGAL AND POLITICAL FEASIBILITY,
W71-03866 06E

OSTROM, VINCENT
CONDITIONS OF LEGAL AND POLITICAL FEASIBILITY,
W71-03866 06E

OWER, GARRET
CHESAPEAKE BAY IN LEGAL PERSPECTIVE,
W71-04337 06E

PACKER, P. E.
WATERSHED MANAGEMENT IN THE UNITED STATES CONCEPTS AND PRINCIPLES,
W71-04253 03B

PADFIELD, HARLAND
WATER AND CULTURE NEW DECISION RULES FOR OLD INSTITUTIONS,
W71-04296 06E

PARDE, M.
EVALUATION OF MAXIMUM FLOW OF FLOODS USING PRECIPITATION DATA (FRENCH),
W71-03983 02A

PARDO, ARVID
DEVELOPMENT OF OCEAN SPACE--AN INTERNATIONAL DILEMMA,
W71-04098 06E

PARSONS, WARD C.
SPRAY IRRIGATION OF WASTES FROM THE MANUFACTURE OF HARDBOARD,
W71-03886 05D

PASCALE, A. S.
SECOND REPORT ON HORIZONTAL-TUBE MULTIPLE-EFFECT PROCESS PILOT PLANT TESTS AND DESIGN,
W71-04220 03A

PAULSON, JOSEPH H.
IRRIGATION AS A FARM GROWTH STRATEGY,
W71-04290 03F

PAUL, J.
HYDROGRAPH SYNTHESIS FOR WATERSHED SUBZONES FROM MEASURED URBAN PARAMETERS,
W71-04184 04C

PAYNE, B. R.
VARIATION OF THE TRITIUM AND OXYGEN-18 CONTENT IN PRECIPITATION AND SNOWPACK IN A REPRESENTATIVE BASIN IN CZECHOSLOVAKIA,
W71-04135 02A

PEDGLEY, D. E.
THE CLIMATE OF INTERIOR OMAN,
W71-04227 02B

PETERSON, STANLEY A.
ANAEROBIC DIGESTION FAILURES,
W71-03891 05D

PHILLIPS, R. E.
THE DIFFUSION OF COPPER, MANGANESE, AND ZINC AS AFFECTED BY CONCENTRATION, CLAY MINERALOGY, AND ASSOCIATED ANIONS,
W71-03942 02G

PIFER, JOSEPH
WATER TABLE DECLINE AND RESULTANT AGRICULTURAL PATTERNS IN THE SALT RIVER VALLEY OF ARIZONA,
W71-04065 03F

PITTMAN, EDWARD D.
USE OF PORE CASTS AND SCANNING ELECTRON MICROSCOPE TO STUDY PORE GEOMETRY,
W71-03946 07B

POLKOWSKI, LAWRENCE B.
DESIGN CAPACITIES TO ACCOMMODATE FORECAST UNDERTAINTIES,
W71-04026 06A

POMEROY, BRUCE A.
COMPUTER DESIGN OF SEWAGE TREATMENT PLANTS,
W71-03893 05D

PURUSHOTHAM, G.
EXPERIMENTAL STUDIES ON LINEAR PROPORTIONAL WEIRS WITH TRIANGULAR BOTTOMS,
W71-04129 08B

RACHNER, M.
SOME RESULTS OF INVESTIGATION AND REPRESENTATION OF SNOW SUPPLY AND THE MELTING OF SNOW,
W71-04174 02C

RADOMSKI, J. L.
THE ELECTRON CAPTURE DETECTOR IN THE ANALYSIS OF CHLORINATED HYDROCARBON PESTICIDES IN TISSUES WITH AND WITHOUT CLEAN-UP,
W71-04214 05A

RAFFA, U.
PROBABLE FLOOD DISCHARGES OF THE PO RIVER TRIBUTARIES,
W71-03987 02E

RAINBIRD, A. F.
LECTURE 1 - FACTORS INFLUENCING RAINFALL FORMATION AND DISTRIBUTION,
W71-04160 02B

LECTURE 2 - PROBABLE MAXIMUM PRECIPITATION (PMP) ESTIMATION,
W71-04161 02B

LECTURE 3 - STORM MAXIMIZATION TECHNIQUES IN EQUATORIAL/TROPICAL REGIONS,
W71-04162 02B

LECTURE 4 - ESTIMATION OF PMP AND MAXIMUM FLOODS BY STATISTICAL METHODS,
W71-04163 02B

RAININ, V. E.
DETERMINATION OF SOIL PERMEABILITY BY THE METHOD OF LARGE RINGS,
W71-04006 02G

RAJARATNAM, N.
THE TRAPEZOIDAL FREE OVERFALL,
W71-04128 08B

RAMSEY, RALPH H.
A MULTI-PHASIC COMPONENT STUDY TO PREDICT STORM WATER

POLLUTION FROM URBAN AREAS,
W71-03917 05C

RASCHKE, RONALD L.
USE OF A FLOATING PERIPHYTON SAMPLER FOR WATER POLLUTION SURVEILLANCE,
W71-04194 05B

REVELLE, C.
REPLY,
W71-04035 06B

REY, ALBERTO
THE ELECTRON CAPTURE DETECTOR IN THE ANALYSIS OF CHLORINATED HYDROCARBON PESTICIDES IN TISSUES WITH AND WITHOUT CLEAN-UP,
W71-04214 05A

RHOADES, J. D.
ADSORPTION OF BORON BY FERROMAGNESIAN MINERALS AND MAGNESIUM HYDROXIDE,
W71-03939 02G

RICE, RAYMOND M.
WETTING AGENT FAILS TO CURB EROSION FROM BURNED WATERSHED,
W71-04250 04D

RICHARDS, H. J.
WATER MOVEMENT IN THE UNSATURATED ZONE OF HIGH AND LOW PERMEABILITY STRATA BY MEASURING NATURAL TRITIUM,
W71-04138 02A

RING, CHESTER A.
CAN COSTS BE CUT,
W71-04284 06C

ROBERTS, CHARLES W.
CAN COSTS BE CUT,
W71-04284 06C

ROBERTS, MICHAEL C.
THE INFLUENCE OF LANDFORM AND PRECIPITATION PARAMETERS ON FLOOD HYDROGRAPHS,
W71-03871 02E

ROBERTS, R. M.
DEVELOPMENT OF ECONOMICAL METHODS OF BORON REMOVAL FROM IRRIGATION RETURN WATERS,
W71-03914 05D

ROBINSON, A. R.
TECHNOLOGY FOR SEDIMENT CONTROL IN URBAN AREAS,
W71-04148 04D

RODNEY, D. R.
ROOTSTOCKS FOR VALENCIA ORANGES AND LIBSON LEMONS IN ARIZONA,
W71-04059 03F

ROGERSON, T. L.
HALF-MINUTE COUNTS FOR NEUTRON PROBES,
W71-04259 07B

ROMANS, J. B.
SURFACE CHEMISTRY STUDIES ON THE BAY OF PANAMA,
W71-04001 02L

ROSE, S. H.
TREATMENT OF ACID MINE DRAINAGE BY FOAM SEPARATION,
W71-04188 05D

ROSTOMOV, C. D.
METHOD OF ESTIMATING STORM RUNOFF FROM SMALL DRAINAGE BASINS,
W71-03992 02E

ROTHACHER, JACK
INCREASES IN WATER YIELD FOLLOWING CLEAR-CUT LOGGING IN THE PACIFIC NORTHWEST,
W71-04240 03B

ROWELL, C. H. FRASER
ENVIRONMENTAL CONTROL OF COLORATION IN AN ACRIDID, GASTRIMARGUS AFRICANUS (SAUSSURE),
W71-04302 03F

ROWE, P. C.
WATER MOVEMENT IN THE UNSATURATED ZONE OF HIGH AND LOW PERMEABILITY STRATA BY MEASURING NATURAL TRITIUM,
W71-04138 02A

RUSSEL, CLIFFORD S.
A QUANTITATIVE FRAMEWORK FOR RESIDUALS--ENVIRONMENTAL QUALITY MANAGEMENT,
W71-03858 05G

SANTEFORD, HENRY S.
WASTE WATER RESULTING FROM THE CONCENTRATION OF LOW GRADE IRON ORE,
W71-04083 05D

SARMA, S. V. KAMESWARA
SIMILITUDE CONCEPT IN PARTIALLY SATURATED SOILS,
W71-04131 02G

SASTRI, C. V. S.
SOME ASPECTS OF DROUGHT CLIMATOLOGY OF THE DRY SUBHUMID ZONES OF SOUTH INDIA,
W71-04298 02B

SCARLET, VIRGINIA B.
EUTROPHICATION OF WATER RESOURCES OF NEW YORK STATE, OBSERVATIONS ON NUTRIENT LIMITATION ON SUMMER PHYTOPLANKTON IN CAYUGA LAKE, 1967 AND 1968,
W71-03923 02H

SCHAAKE, JOHN C., JR.
MATHEMATICAL PROGRAMMING APPLICATIONS TO WATER QUALITY PLANNING FOR THE BOSTON HARBOR REGION,
W71-04036 05G

SCHAFFNER, WILLIAM
EUTROPHICATION OF WATER RESOURCES OF NEW YORK STATE, OBSERVATIONS ON NUTRIENT LIMITATION ON SUMMER PHYTOPLANKTON IN CAYUGA LAKE, 1967 AND 1968,
W71-03923 02H

SCHEIDEGGER, A. E.
CHAIN MODEL OF RIVER MEANDERS,
W71-04124 02E

SCHUSTER, ROBERT P.
THE DOCTRINE OF CONSEQUENTIAL LOSS AS AFFECTED BY VALUATION FORMULAS,
W71-04031 06E

SCHWOB, HARLAN H.
FLOOD PROFILE STUDY, HOOSIER CREEK, LINN COUNTY, IOWA,
W71-03932 02E

SHAHBAZI, MOHSEN
ANALYTICAL SOLUTION OF THE LAPLACE EQUATION IN REGIONAL GROUNDWATER FLOW FIELD,
W71-04130 02F

SHAH, DINESH O.
STRUCTURE OF WATER IN MICROEMULSIONS ELECTRICAL, BIREFRINGENCE, AND NUCLEAR MAGNETIC RESONANCE STUDIES,
W71-04108 01B

SHASTRY, R. S.
MODELING AND OPTIMIZATION OF WATER RESOURCES SYSTEMS - PHASE I,
W71-04043 06A

SHATSOV, A. N.
RADIOMETRIC INVESTIGATIONS ON THE BEACH AT THE MOUTH OF THE KURA RIVER,
W71-03962 02J

SHCHERBAK, G. M.
CHARACTERISTICS OF THE CONSTRUCTION OF EQUALLY PROBABLE FLASH FLOOD HYDROGRAPHS,
W71-03976 02E

SHCHERBAK, L. V.
WATER DISCHARGE TRAVEL TIME COEFFICIENTS,
W71-03973 02E

SHELTON, RONALD L.
EVALUATION OF INTANGIBLES,
W71-04273 06B

SHERIFF, ROBERT E.
GLOSSARY OF TERMS USED IN WELL LOGGING,
W71-04113 10

SHIH, CHIA SHUN
SYSTEM OPTIMIZATION FOR RIVER BASIN WATER QUALITY MANAGEMENT,
W71-03881 05G

SHRIVASTAVA, P. C.
A MECHANICAL DEVICE FOR RELEASING FLUORESCENT TRACERS,
W71-03949 07B

SHTEYMAN, B. S.
RADIOMETRIC INVESTIGATIONS ON THE BEACH AT THE MOUTH OF THE KURA RIVER,
W71-03962 02J

SHULITS, SAM
BEDLOAD FORMULAS. PART A. A SELECTION OF BEDLOAD FORMULAS. PART B. PROGRAM LISTINGS FOR BEDLOAD FORMULAS,
W71-03999 02E

SHULOV, A. S.
THE DEVELOPMENT OF EGGS OF THE RED LOCUST NOMADACRIS SEPTEMFASCIATA (SERV.), AND THE AFRICAN MIGRATORY LOCUST, LOCUSTA MIGRATORIA MIGRATORIODES (R. AND F.), AND ITS INTERRUPTION UNDER PARTICULAR CONDITIONS OF HUMIDITY,
W71-04297 03F

SIMPSON, I. G.
NEW APPROACHES TO IRRIGATED FARMING IN THE SUDAN ORGANIZATION AND MANAGEMENT,
W71-04231 03F

SINGLETON, F.
THE CALCULATION OF RAINFALL FROM A HURRICANE,
W71-03993 02B

SINNOT, WALTER B.
CAN COSTS BE CUT,
W71-04284 06C

SKOLD, MELVIN D.
THE IMPACT OF AGRICULTURAL CHANGE ON A LOCAL ECONOMY IN THE GREAT PLAINS,
W71-04289 03F

EVALUATION OF IRRIGATION WATER AND NITROGEN FERTILIZER IN CORN PRODUCTION,

W71-04304 03F

SKVORTSOVA, G. F.
CONCRETE FOR KRASNOLARSK DAM,
W71-04004 08F

SMELKOV, L. L.
DETERMINING THE CRITICAL SPEEDS OF HYDRAULIC UNIT SHAFTS,
W71-03996 08C

SMITH, COURTLAND L.
WATER AND CULTURE NEW DECISION RULES FOR OLD INSTITUTIONS,
W71-04296 06E

SMITH, DAVID LAWRENCE
SUPERFARMS VS. SAGEBRUSH NEW IRRIGATION DEVELOPMENTS ON THE SNAKE RIVER PLAIN,
W71-04056 03F

SMITH, D. B.
WATER MOVEMENT IN THE UNSATURATED ZONE OF HIGH AND LOW PERMEABILITY STRATA BY MEASURING NATURAL TRITIUM,
W71-04138 02A

SMITH, JAMES T.
GROUNDWATER RESOURCES OF COLLINGSWORTH COUNTY, TEXAS,
W71-03935 02F

SOKOLOV, A. A.
METHODS OF SNOWMELT MAXIMUM DISCHARGE COMPUTATION IN CASES OF ABSENCE OR INSUFFICIENCY OF HYDROMETRIC DATA,
W71-04177 02C

SOLOV'YEV, N. YA.
ROD-MOUNTED BOTTOM GRAB,
W71-03967 07B

SPEECE, RICHARD E.
THE EFFECT OF SHORT-TERM TEMPERATURE VARIATIONS ON METHANE PRODUCTION,
W71-04077 05D

SPOFFORD, WALTER O.
A QUANTITATIVE FRAMEWORK FOR RESIDUALS--ENVIRONMENTAL QUALITY MANAGEMENT,
W71-03858 05G

STARITSKII, V. G.
EXPERIMENTAL INVESTIGATIONS OF HYDRAULIC TURBINES WITH COMBINED RUNNERS,
W71-03998 08C

STEPHAN, ROBERT W.
A REVIEW OF CURRENT RESEARCH ON COAL MINE DRAINAGE IN APPALACHIA,
W71-03874 05B

FACTORS THAT AFFECT THE FORMATION OF COAL MINE DRAINAGE POLLUTION IN APPALACHIA,
W71-03875 05B

SURVEY OF COSTS ON METHODS FOR CONTROL OF ACID MINE DRAINAGE POLLUTION,
W71-03877 05B

STEPHEN, ROBERT W.
THE OXIDATION OF PYRITE ASSOCIATED WITH COAL MINES,
W71-03876 05B

STICHLER, W.
DEUTERIUM MEASUREMENTS ON SNOW SAMPLES FROM THE ALPS,
W71-04136 02A

STILES, KENNETH R.
OFFSHORE OIL SPILLS AN EVALUATION OF RECENT UNITED STATES RESPONSES,
W71-04305 06E

STOLTENBERG, DAVID H.
DESIGN CONSTRUCTION AND MAINTENANCE OF WASTE STABILIZATION LAGOONS,
W71-03896 05D

STORRS, P. N.
EFFECTS OF WASTE DISPOSAL INTO MARINE WATERS - A SURVEY OF STUDIES CARRIED OUT IN THE LAST TEN YEARS,
W71-04114 05C

STRIDE, A. H.
TIDAL SAND MOVEMENT BETWEEN SOME LINEAR SAND BANKS IN THE NORTH SEA OFF NORTHEAST NORFOLK,
W71-03953 02J

STROMBERG, K. S.
SECOND REPORT ON HORIZONTAL-TUBE MULTIPLE-EFFECT PROCESS PILOT PLANT TESTS AND DESIGN,
W71-04220 03A

SUBRAHMANYAM, V. P.
SOME ASPECTS OF DROUGHT CLIMATOLOGY OF THE DRY SUBHUMID ZONES OF SOUTH INDIA,
W71-04298 02B

SULLIVAN, LAWRENCE B.
UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME VI. TEST REQUIREMENTS FOR OCEANOGRAPHIC AND METEOROLOGICAL SENSORS,
W71-04014 07B

SUPRUNOV, U. G.
FORMATION OF RAINFALL FLOODS ON SMALL WATERSHEDS. PRINCIPLES OF MAXIMUM STORM RUNOFF COMPUTATION,
W71-03988 02A

SYNNOTT, JOHN C.
THE USE OF AMALGAM ELECTRODES TO MEASURE ACTIVITY COEFFICIENTS IN MULTICOMPONENT SALT SOLUTIONS,
W71-04221 01B

SZESZTAY, K.
SOME PROBLEMS OF DETERMINING THE WATER EQUIVALENT OF THE SNOW COVER,
W71-04173 02C

TABLER, RONALD D.
THE HYDROLOGY OF SAGEBRUSH LANDS AND THE MANAGEMENT OF BLOWING SNOW,
W71-04248 03B

SUMMARY OF SNOW RESEARCH BY THE ROCKY MOUNTAIN FOREST AND RANGE EXPERIMENT STATION AT LARAMIE, WYOMING.,
W71-04249 02C

TAGAMI, M.
MEMBRANE MATERIALS FOR WASTE WATER RECLAMATION BY REVERSE OSMOSIS,
W71-04185 05D

TARLOCK, A. DAN
THE LEGAL SYSTEM STRUCTURE OR CONSTRAINT FOR SYSTEMS ANALYSIS DECISION-MAKING,
W71-03865 06E

TEDROW, ALLEN C.
PLANNING FOR THE OSWEGO BASIN IN NEW YORK--A SYSTEMS APPROACH,
W71-03860 06A

TELLER, AZRIEL
THE EVALUATION OF THE COST OF ALTERNATIVE STRATEGIES FOR AIR POLLUTION CONTROL,
W71-03859 06A

TEW, RONALD K.
SOIL MOISTURE DEPLETION AND ESTIMATED EVAPOTRANSPIRATION ON UTAH MOUNTAIN WATERSHED,
W71-04242 02D

THAKUR, T. R.
CHAIN MODEL OF RIVER MEANDERS,
W71-04124 02E

THOMAS, H. E.
INSURING MAXIMUM BENEFICIAL USE OF WATER THROUGH LEGISLATION,
W71-04099 06E

THORP, M. B.
SOME ASPECTS OF THE GEOMORPHOLOGY OF THE AIR MOUNTAINS, SOUTHERN SAHARA,
W71-04050 02G

THURSBY, J. W.
THE DELAWARE RIVER BASIN COMPACT--AN ALTERNATIVE FOR IMPLEMENTING WATER RESOURCES MANAGEMENT (ORGANIZATION, OPERATION, AND RESULTS OF THE BASIN COMPACT),
W71-04089 06E

TIBBS, NICHOLAS HOWARD
THE BACKGROUND CONCENTRATIONS OF COPPER, LEAD, AND ZINC IN STREAMS OF THE 'NEW LEAD BELT', MISSOURI,
W71-04182 05A

TIMMONS, DONALD R.
ACCUMULATION OF PHOSPHATES IN WATER,
W71-04216 05B

TIM, TAN HOE
THE PROBLEM OF FLOOD PREDICTION ON THE EAST COAST OF WEST MALAYSIA,
W71-04167 02B

TIRTHA, RANJIT
SPATIAL PATTERNS OF SOCIO-ECONOMIC STRUCTURE IN INDIA,
W71-04234 06B

TOEBES, GERRIT H.
RESOURCE SYSTEMS MODELS IN DECISION MAKING,
W71-03856 06A

TOWE, K. M.
MICROBIAL CARBONATE AND PHOSPHATE PRECIPITATES FROM SEA WATER CULTURES,
W71-03950 02K

TRAUTWEIN, NORMAN L.
SPECTROPHOTOMETRIC DETERMINATION OF CHLORATE ION,
W71-03994 02K

TRIPP, JAMES T. B.
FEDERAL ENFORCEMENT UNDER THE REFUSE ACT OF 1899,
W71-04102 06E

TRUDEAU, R. C.
POROUS TUBULET SUPPORTS FOR DESALINATION BARRIERS,
W71-03911 03A

TSITSAREV, A. N.
RADIOMETRIC INVESTIGATIONS ON THE BEACH AT THE MOUTH OF THE KURA RIVER,
W71-03962 02J

TSOVYAN, M. V.
COMPUTATION OF MAXIMUM STORM DISCHARGE OF MOUNTAIN RIVERS,
W71-03982 02A

TUTHILL, DEAN F.
ECONOMIC ANALYSIS OF MARINAS IN MARYLAND,
W71-04267 06D

TYBOUT, RICHARD A.
PRIVATE AND SOCIAL COSTING AND PRICING AS DECISION DETERMINANTS,
W71-03863 06C

UDA, M.
THE STRUCTURE AND MORPHOLOGY OF INORGANIC MEMBRANES,
W71-04224 03A

VANDENBERG, A.
GEOHYDROLOGIC BOUNDARY ENVELOPES,
W71-04125 02F

VENETIS, C.
FINITE AQUIFERS CHARACTERISTIC RESPONSES AND APPLICATIONS,
W71-04126 02F

VINOGRADOV, YU. B.
SOME ASPECTS OF THE FORMATION OF MUDFLOWS AND METHODS OF COMPUTING THEM,
W71-03963 02J

VISHNEVSKIY, P. F.
CHARACTERISTICS OF THE CONSTRUCTION OF EQUALLY PROBABLE FLASH FLOOD HYDROGRAPHS,
W71-03976 02E

VOFSI, D.
WATER TRANSPORT THROUGH PLASTICIZED MEMBRANES,
W71-03912 03A

WALKER, J. F.
APPLICATION OF INDUSTRIAL DYNAMICS CONCEPTS TO DECISION MAKING IN ENVIRONMENTAL MANAGEMENT,
W71-04025 05G

WALL, GLENN R.
ESTABLISHING AN ENGINEERING BASIS FOR FLOOD PLAIN REGULATIONS,
W71-04270 04A

WALTERS, PAUL R.
A MULTI-PHASIC COMPONENT STUDY TO PREDICT STORM WATER POLLUTION FROM URBAN AREAS,
W71-03917 05C

WALTON, WILLIAM CLARENCE
THE WORLD OF WATER,
W71-04118 02A

WARD, J. C.
ECONOMICS OF THERMAL POLLUTION CONTROL,
W71-04084 05D

WASHINGTON, DONALD R.
SOLIDS SEPARATION BY ULTRAFILTRATION FOR CONCENTRATED ACTIVATED SLUDGE,
W71-04087 05D

WAUGH, J. R.
THE RELATIONSHIP BETWEEN SUMMER LOW FLOWS AND GEOLOGY IN NORTHLAND, NEW ZEALAND,
W71-03931 02A

WAZIRUDDIN, S.
APPLYING GRADIENT PROJECTION AND CONJUGATE GRADIENT TO THE OPTIMUM OPERATION OF RESERVOIRS,
W71-04030 04A

A NONLINEAR MULTIPLE RESERVOIR WATER RESOURCES MODEL WITH MULTIPLE PURPOSES,
W71-04044 04A

OPTIMUM OPERATION OF MULTIPLE RESERVOIRS WITH MULTIPLE PURPOSES,
W71-04046 04A

WEARN, P. L.
WATER MOVEMENT IN THE UNSATURATED ZONE OF HIGH AND LOW PERMEABILITY STRATA BY MEASURING NATURAL TRITIUM,
W71-04138 02A

WEBBER, JAMES
CONSTRUCTION COST OUTLOOK - 1970-1971,
W71-04275 06C

WEBER, CORNELIUS I.
A NEW FRESHWATER CENTRIC DIATOM MICROSIPHONA POTAMOS GEN. ET SP. NOV.,
W71-04193 05C

USE OF A FLOATING PERIPHYTON SAMPLER FOR WATER POLLUTION SURVEILLANCE,
W71-04194 05B

METHODS OF COLLECTION AND ANALYSIS OF PLANKTON AND PERIPHYTON SAMPLES IN THE WATER POLLUTION SURVEILLANCE SYSTEM,
W71-04195 05A

PERIPHYTON BIOMASS-CHLOROPHYLL RATIO AS AN INDEX OF WATER QUALITY,
W71-04206 05A

THE PRESERVATION OF PHYTOPLANKTON GRAB SAMPLES,
W71-04207 05A

PHYTOPLANKTON, SESTON, AND DISSOLVED ORGANIC CARBON IN THE LITTLE MIAMI RIVER AT CINCINNATI, OHIO,
W71-04209 05A

A GUIDE TO THE COMMON DIATOMS AT WATER POLLUTION SURVEILLANCE SYSTEM STATIONS,
W71-04210 07C

A STUDY OF PHOTOSYNTHESIS IN CLEAR LAKE, IOWA,
W71-04212 05C

WHIPPLE, WM., JR.
PRIVATE AND SOCIAL COSTING AS DECISION DETERMINANTS IN WATER RESOURCES,
W71-03864 06B

WHITE, EARL R.
GAS CHROMATOGRAPHIC SEPARATIONS OF MIXED CHLORINATED FUNGICIDES,
W71-04213 05A

WHITE, ROY A.
POROUS TUBULET SUPPORTS FOR DESALINATION BARRIERS,
W71-03911 03A

WHITLEY, JAMES R.
THE EVALUATION OF ENVIRONMENTAL ALTERATION BY THERMAL LOADING AND ACID POLLUTION IN THE COOLING RESERVOIR OF A STEAM-ELECTRIC STATION,
W71-04019 05C

WHITNACK, G. C.
ARSENIC IN POTABLE DESERT GROUNDWATER AN ANALYSIS PROBLEM,
W71-04109 02K

WIEBE, HERMAN H.
WATER POTENTIAL MEASUREMENTS IN TRESS,
W71-04238 02I

WIERSMA, JOHN L.
INFLUENCE OF LOW RATES OF WATER APPLICATION BY SPRINKLERS ON THE MICROCLIMATE,
W71-03925 02D

WILKINS, BRUCE T.
AN ECOLOGICAL CRITERION FOR EVALUATING AN ENVIRONMENT,
W71-04274 06B

WILLIAMS, HOWARD M.
MOLE DRAINAGE,
W71-04008 08A

WILLIMON, EUGENE P., JR.
MULTI-STAGE BIOLOGICAL PROCESSES FOR WASTE TREATMENT,
W71-03894 05D

WILLIS, WAYNE O.
AN ECONOMIC ANALYSIS OF LEVEL BENCH SYSTEMS FOR FORAGE PRODUCTION IN NORTH DAKOTA,
W71-04265 03F

WILMOTH, ROGER C.
NEUTRALIZATION OF HIGH FERRIC IRON ACID MINE DRAINAGE,
W71-04189 05D

WILSON, JOHN M.
WATER USE IN TENNESSEE, PART D - SUMMARY,
W71-04324 06D

WILTON, J. DANIEL, JR.
UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME V. ANALYSIS OF APPLYING STANDARDIZATION TECHNIQUES TO OCEANOGRAPHIC SENSORS,
W71-04013 07B

WINTER, JOHN A.
METHOD SELECTION STUDY 1 A COMPARISON OF THREE MODIFICATIONS OF THE SINGLE REAGENT METHOD FOR SOLUBLE ORTHOPHOSPHATE,
W71-04204 05A

WINTER, J. A.
FWPCA METHOD STUDY 1 MINERAL AND PHYSICAL ANALYSES - AN EVALUATION OF FWPCA ANALYTICAL METHODS FOR SURFACE WATERS,
W71-04200 05A

WIRTH, P.
CONSTRUCTION OF THE UNIT HYDROGRAPH BY THE METHOD OF HYDROLOGIC ANALOGY (FRENCH),
W71-03981 02E

WISHNEVSKY, P. F.
CALCULATION OF THE MAXIMUM RUNOFF IN FLOODS FROM RAINFALL OVER THE TERRITORIES OF THE UKRAINE AND MOLDAVIA (WITH NO OR INSUFFICIENT HYDROMETRICAL DATA),
W71-03991 02A

WITT, ARTHUR, JR.
THE EVALUATION OF ENVIRONMENTAL ALTERATION BY THERMAL LOADING AND ACID POLLUTION IN THE COOLING RESERVOIR OF A STEAM-ELECTRIC STATION,
W71-04019 05C

WOODSON, B. R.
A WINTER LIMNOLOGICAL STUDY OF LAKE WILCOX A FRESHWATER IMPOUNDMENT,
W71-03957 02H

WRIGHT, JOHN R.
WASTE PROBLEMS RELATIVE TO MINING AND MILLING OF MOLYBDENUM,
W71-03888 05D

WRIGHT, L. W.
VARIATION IN THE LEVEL OF THE CLIFF/SHORE PLATFORM JUNCTION ALONG THE SOUTH COAST OF GREAT BRITAIN,
W71-03952 02J

WROTNOWSKI, ARTHUR C.
FABRICATION OF FELT-MEMBRANE COMPOSITES,
W71-04222 03A

YAKOVLEV, V. I.
REMOTE GROUNDWATER LEVEL METER FOR BOG STATIONS,
W71-03966 07B

YAMAGISHI, YONEJIRO
SOME EXAMPLES OF HEAVY RAINFALL IN JAPAN,
W71-04166 02B

YEARGAN, JERRY R.
UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME IV. THE FORMATTING AND TRANSMISSION OF DATA FROM OCEANOGRAPHIC SENSORS,
W71-04012 07B

YEH, WILLIAM W. G.
OPTIMUM FIRE POWER OUTPUT FROM A TWO RESERVOIR SYSTEM BY INCREMENTAL DYNAMIC PROGRAMMING,
W71-04111 04A

YEMEL'YANOV, A. A.
RADIOMETRIC INVESTIGATIONS ON THE BEACH AT THE MOUTH OF THE KURA RIVER,
W71-03962 02J

YEN, C. K.
VARIATION OF THE TRITIUM AND OXYGEN-18 CONTENT IN PRECIPITATION AND SNOWPACK IN A REPRESENTATIVE BASIN IN CZECHOSLOVAKIA,
W71-04135 02A

YOUNG, GALE
DRY LANDS AND A HUNGRY WORLD,
W71-04291 06B

YOUNG, G. K.
AN APPROACH TO FINDING RESERVOIR RULES FOR POWER OPTIMIZATION,
W71-04037 04A

YOUNG, JAMES C.
THE ANAEROBIC FILTER FOR WASTE TREATMENT,
W71-04075 05D

YOUNG, RALPH A.
INFLUENCE OF MANAGEMENT AND ENVIRONMENTAL FACTORS ON EXTENT OF SOIL WATER DEPLETION BY SPRING WHEAT,
W71-04303 03F

ZABLATZKY, HERMAN R.
ANAEROBIC DIGESTION FAILURES,
W71-03891 05D

ZAKI, M. A. F.
ROOT DEVELOPMENT OF TWO COMMON SPECIES IN DIFFERENT HABITATS IN THE MEDITERRANEAN SUBREGION IN EGYPT,
W71-04300 02I

ZASLAVSKY, DAN
SATURATION-UNSATURATION TRANSITION IN INFILTRATION TO A NON-UNIFORM SOIL PROFILE,
W71-04066 02G

ZAVALISHIN, I. S.
PRECAST REINFORCED CONCRETE IN HYDRAULIC CONSTRUCTION,
W71-04015 08F

ZELENY, V.
RUNOFF CONDITIONS DURING SNOW THAWING IN THE MORAVIAN-SILESIAN BESKIDS,
W71-04175 02C

ZHELESNIAK, J. A.
A METHOD FOR THE CALCULATION OF SPRING FLOODS,
W71-04178 02E

ZIMMERMANN, U.
STABLE ISOTOPES IN STUDY OF WATER BALANCE OF LAKE NEUSIEDL, AUSTRIA INVESTIGATION OF THE RELIABILITY OF THE STABLE ISOTOPE METHOD,
W71-04141 02A

ZIMONT, I. L.
FORMATION OF RAINFALL FLOODS ON SMALL WATERSHEDS. PRINCIPLES OF MAXIMUM STORM RUNOFF COMPUTATION,
W71-03988 02A

ZINCHENKO, N. A.
CONCRETE FOR KRASNOLARSK DAM,
W71-04004 08F

ZNAMENSKAYA, N. S.
HYDRAULIC CRITERIA OF STREAMS WITH A MOBILE BOTTOM,
W71-03965 02J

ZSUFFA, I.
ANALYSIS OF THE RELATION BETWEEN PRECIPITATION AND FLOOD FLOW WITH THE AID OF A TRIPLE TRANSFORMATION BASED ON THE UNIT HYDROGRAPH METHOD (FRENCH),
W71-03980 02A

CONSTRUCTION OF THE UNIT HYDROGRAPH BY THE METHOD OF HYDROLOGIC ANALOGY (FRENCH),
W71-03981 02E

ANALYSIS OF FLOOD DURATION (FRENCH),
W71-03984 02E

ORGANIZATIONAL INDEX

AEROJET-GENERAL CORP., EL MONTE, CALIF.
DEVELOPMENT OF ECONOMICAL METHODS OF BORON REMOVAL FROM IRRIGATION RETURN WATERS,
W71-03914 05D

AGRICULTURAL RESEARCH SERVICE, MORRIS, MINN. NORTH CENTRAL SOIL CONSERVATION RESEARCH CENTER.
ACCUMULATION OF PHOSPHATES IN WATER,
W71-04216 05B

AGRICULTURAL RESEARCH SERVICE, RIVERSIDE, CALIF. SOIL AND WATER CONSERVATION RESEARCH DIV.
ADSORPTION OF BORON BY FERROMAGNESIAN MINERALS AND MAGNESIUM HYDROXIDE,
W71-03939 02G

AGRICULTURAL RESEARCH SERVICE, WASHINGTON, D.C. SEDIMENTATION LAB.
TECHNOLOGY FOR SEDIMENT CONTROL IN URBAN AREAS,
W71-04148 04D

AGRICULTURAL RESEARCH SERVICE. NORTHERN PLAINS BRANCH AND NEBRASKA UNIV., LINCOLN. AGRICULTURAL EXPERIMENT STATION.
MICROBIAL POPULATIONS IN STUBBLE-MULCHED SOIL,
W71-04068 02G

AHMADU BELLO UNIV., ZARIA (NIGERIA). DEPT. OF GEOGRAPHY.
SOME ASPECTS OF THE GEOMORPHOLOGY OF THE AIR MOUNTAINS, SOUTHERN SAHARA,
W71-04050 02G

AKADEMIYA NAUK ARMYANSKOI SSR, EREVAN AND MINISTRY OF RECLAMATION AND WATER ECONOMY, EREVAN (USSR). WATER PROBLEMS AND HYDROTECHNICS RESEARCH INST.
COMPUTATION OF MAXIMUM STORM DISCHARGE OF MOUNTAIN RIVERS,
W71-03982 02A

AKADEMIYA NAUK SSSR, MOSCOW. INSTITUT GEOGRAFII.
MAP OF TOTAL STREAMFLOW FROM THE TERRITORY OF THE SOVIET UNION,
W71-03960 02E

GEOGRAPHICAL ASPECTS OF THE USE OF WATER RESOURCES IN THE SOVIET ECONOMY,
W71-04052 03F

ALBERTA UNIV., EDMONTON.
CLIMATE AND OVERGRAZING ON THE SHONTO PLATEAU, ARIZONA,
W71-04064 03F

ALBERTA UNIV., EDMONTON. DEPT. OF CIVIL ENGINEERING.
THE TRAPEZOIDAL FREE OVERFALL,
W71-04128 08B

ALBERTA UNIV., EDMONTON. DEPT. OF ZOOLOGY.
LIMNOLOGICAL FEATURES OF A NORTHERN BROWN-WATER STREAM, WITH SPECIAL REFERENCES TO THE LIFE HISTORIES OF THE AQUATIC INSECTS,
W71-04215 05C

ALBERTO UNIV., EDMONTON. DEPT. OF AGRICULTURAL ECONOMICS AND RURAL SOCIOLOGY.
A STUDY OF WATER USE IN SINGLE-DWELLING RESIDENCES IN THE CITY OF CALGARY, ALBERTA, ALBERTA UNIV., EDMONTON (CANADA),
W71-04287 03D

AMERICAN WATER WORKS SERVICE CO., INC., PHILADELPHIA, PA.
ECONOMIC CONSIDERATIONS IN FACILITY PLANNING,
W71-04285 06B

ANDHRA UNIV., WALTAIR (INDIA). DEPT. OF METEOROLOGY AND OCEANOGRAPHY.
SOME ASPECTS OF DROUGHT CLIMATOLOGY OF THE DRY SUBHUMID ZONES OF SOUTH INDIA,
W71-04298 02B

ANTI-LOCUST RESEARCH CENTRE, LONDON (ENGLAND).
THE CLIMATE OF INTERIOR OMAN,
W71-04227 02B

ARCTIC CONSTRUCTION AND FROST EFFECTS LAB., BOSTON, MASS.
MOLE DRAINAGE,
W71-04008 08A

ARIZONA AGRICULTURAL EXPERIMENT STATION, YUMA AND ARIZONA AGRICULTURAL EXPERIMENT STATION, PHOENIX, SALT RIVER VALLEY CITRUS FARM.
ROOTSTOCKS FOR VALENCIA ORANGES AND LIBSON LEMONS IN ARIZONA,
W71-04059 03F

ARIZONA UNIV., TUCSON.
MOVEMENT OF ALGAL- AND FUNGAL-BOUND RADIOSTRONTUM AS CHELATE COMPLEXES IN A CALCAREOUS SOIL,
W71-04067 05B

ARIZONA UNIV., TUCSON. BUREAU OF ETHNIC RESEARCH.
WATER AND CULTURE NEW DECISION RULES FOR OLD INSTITUTIONS,
W71-04296 06E

ARIZONA UNIV., TUCSON. COLL. OF AGRICULTURE.
THE SAM SIMON WATERSHED SHRUB CONTROL,
W71-04058 03F

ELEVATION AND TEMPERATURE EFFECTS ON SEVERITY OF MAIZE DWARF MOSAIC VIRUS IN SORGHUM,
W71-04060 03F

ARIZONA UNIV., TUCSON. DEPT. OF AGRICULTURAL ECONOMICS.
COMPETITION FOR WATER IN AN EXPANDING ECONOMY POLICIES AND INSTITUTIONS,
W71-04268 06E

ARIZONA UNIV., TUCSON. DEPT. OF AGRICULTURAL ENGINEERING.
COMPUTER AIDS GROUNDWATER RESOURCES RESEARCH PROJECT,
W71-04057 02F

ARIZONA UNIV., TUCSON. DEPT. OF CIVIL ENGINEERING AND ENGINEERING MECHANICS.
QUALITY OF RUNOFF FROM DIVERSIFIED URBAN WATERSHEDS,
W71-03929 05A

ARIZONA UNIV., TUCSON. DEPT. OF HYDROLOGY AND WATER RESOURCES.
ECONOMIC FEASIBILITY OF SELECTIVE ADJUSTMENT IN USE OF SALVAGEABLE WATERS IN THE TUCSON REGION, ARIZONA,
W71-04269 05D

ARIZONA UNIV., TUCSON. HYDROLOGY AND WATER RESOURCES.
OPTIMAL OPERATION OF WATER SUPPLY SYSTEMS,
W71-04042 04B

ARKANSAS UNIV., FAYETTEVILLE. DEPT. OF ZOOLOGY.
INFLUENCE OF TEMPERATURE AND PHOTOPERIOD ON GROWTH, FOOD CONSUMPTION AND FOOD CONVERSION EFFICIENCY OF CHANNEL CATFISH,
W71-03920 05C

ARMY ENGINEER DISTRICT, FORT WORTH, TEX.
FLOOD PLAIN INFORMATION, KIRBY CREEK, GRAND PRAIRIE, TEXAS.
W71-04143 04A

ARMY ENGINEER DISTRICT, OMAHA, NEBR. DESIGN BRANCH.
NATURE'S LAW AND MAN'S ETHIC,
W71-04069 04C

ARYA MEHR INDUSTRIAL UNIV., TEHRAN (IRAN). DEPT. OF MECHANICAL ENGINEERING.
ANALYTICAL SOLUTION OF THE LAPLACE EQUATION IN REGIONAL GROUNDWATER FLOW FIELD,
W71-04130 02F

ASTON UNIV., BIRMINGHAM (ENGLAND).
A RAPID METHOD OF COMPUTING AREAL RAINFALL,
W71-04123 07B

ATLANTIC OCEANOGRAPHIC AND METEOROLOGICAL LABS., MIAMI, FLA.
MINERAL AND CHEMICAL COMPOSITION OF SEDIMENTS FROM THE STRAITS OF FLORIDA,
W71-03944 02J

ATMOSPHERIC SCIENCES LAB., WHITE SANDS MISSILE RANGE, N. MEX.
A MORE RIGOROUS EXPRESSION FOR THE RATE OF DROPLET GROWTH,
W71-04005 03B

ATOMIC ENERGY OF CANADA LTD., CHALK RIVER (ONTARIO). CHALK RIVER NUCLEAR LABS.
DISTRIBUTION OF HYDROGEN ISOTOPES IN CANADIAN WATERS,
W71-04134 02A

PERCH LAKE EVAPORATION STUDY,
W71-04142 02A

ATOMIC ENERGY RESEARCH ESTABLISHMENT, WANTAGE (ENGLAND). RESEARCH LAB. WATER RESOURCES BOARD, READING (ENGLAND) AND HYDROLOGICAL RESEARCH UNIT, WALLINGFORD (ENGLAND).
WATER MOVEMENT IN THE UNSATURATED ZONE OF HIGH AND LOW PERMEABILITY STRATA BY MEASURING NATURAL TRITIUM,
W71-04138 02A

AVCO ECONOMIC SYSTEMS CORP., WASHINGTON, D.C.
A MULTI-PHASIC COMPONENT STUDY TO PREDICT STORM WATER POLLUTION FROM URBAN AREAS,
W71-03917 05C

BAYLOR UNIV., WACO, TEX.
THE STRUCTURE AND MORPHOLOGY OF INORGANIC MEMBRANES,
W71-04224 03A

BERGEN COUNTY SEWER AUTHORITY, LITTLE FERRY, N.J.
ANAEROBIC DIGESTION FAILURES,
W71-03891 05D

BETHELHEM STEEL CORP., CHESTERTON, IND. BURNS HARBOR PLANT.
WASTE WATER TREATMENT FACILITIES AT BURNS HARBOR,
W71-04080 05D

BIRMINGHAM UNIV. (ENGLAND). CENTRE FOR WEST AFRICAN STUDIES.
FARMING, FOREST AND SAVANNA IN WESTERN NIGERIA,
W71-04054 03F

BOSTOCK, HILL AND RIGBY, BIRMINGHAM (ENGLAND).
PRETREATMENT OF TOXIC WASTES,
W71-04082 05D

BOWDOIN COLL., BRUNSWICK, MAINE AND WISCONSIN UNIV., MADISON.
BENEFIT-COST ANALYSIS AND MULTIPLE OBJECTIVES CURRENT ISSUES IN WATER RESOURCES PLANNING,
W71-04023 06C

BOYLE ENGINEERING, LAS VEGAS, NEV. AND CORNELL, HOWLAND,

HAYES, AND MERRYFIELD, LAS VEGAS, NEV.
A COMPREHENSIVE WATER QUALITY CONTROL PROGRAM FOR THE LAS VEGAS WASH DRAINAGE BASIN. PHASE I.
W71-03901 05D

A COMPREHENSIVE WATER QUALITY CONTROL PROGRAM FOR THE LAS VEGAS WASH DRAINAGE BASIN.
W71-03902 05D

BRIGHAM YOUNG UNIV., PROVO, UTAH.
MINERAL RECOVERY FROM CONCENTRATED BRINES,
W71-04223 02K

BRITISH METEOROLOGICAL OFFICE, BRACKNELL (ENGLAND).
THE CALCULATION OF RAINFALL FROM A HURRICANE,
W71-03993 02B

BRITISH PETROLEUM CO., LTD SUNBURY-ON-THAMES (ENGLAND) AND NATIONAL INST. OF OCEANOGRAPHY, WORMLEY (ENGLAND).
TIDAL SAND MOVEMENT BETWEEN SOME LINEAR SAND BANKS IN THE NORTH SEA OFF NORTHEAST NORFOLK,
W71-03953 02J

BUREAU OF METEOROLOGY, MELBOURNE (AUSTRALIA). SERVICE DIV.
LECTURE 1 - FACTORS INFLUENCING RAINFALL FORMATION AND DISTRIBUTION,
W71-04160 02B

LECTURE 2 - PROBABLE MAXIMUM PRECIPITATION (PMP) ESTIMATION,
W71-04161 02B

LECTURE 3 - STORM MAXIMIZATION TECHNIQUES IN EQUATORIAL/TROPICAL REGIONS,
W71-04162 02B

LECTURE 4 - ESTIMATION OF PMP AND MAXIMUM FLOODS BY STATISTICAL METHODS,
W71-04163 02B

BUREAU OF MINES, PITTSBURGH, PA. AREA 1 MINERAL RESOURCE OFFICE.
FACTORS THAT AFFECT THE FORMATION OF COAL MINE DRAINAGE POLLUTION IN APPALACHIA,
W71-03875 05B

THE OXIDATION OF PYRITE ASSOCIATED WITH COAL MINES,
W71-03876 05B

SURVEY OF COSTS ON METHODS FOR CONTROL OF ACID MINE DRAINAGE POLLUTION,
W71-03877 05B

BUREAU OF MINES, PITTSBURGH, PA. AREA 1 MINERAL RESOURCES OFFICE.
A REVIEW OF CURRENT RESEARCH ON COAL MINE DRAINAGE IN APPALACHIA,
W71-03874 05B

BUREAU OF PUBLIC ROADS, WASHINGTON, D.C.
THE CONTROL OF EROSION AND SEDIMENT IN HIGHWAY CONSTRUCTION,
W71-04149 04D

BUREAU OF RECLAMATION, DENVER, COLO.
DETERMINING THE CRITICAL SPEEDS OF HYDRAULIC UNIT SHAFTS,
W71-03996 08C

HOT-THERMOS METHOD OF CONCRETING,
W71-03997 08F

EXPERIMENTAL INVESTIGATIONS OF HYDRAULIC TURBINES WITH COMBINED RUNNERS,
W71-03998 08C

STRESS DISTRIBUTION INSIDE HOMOGENEOUS ROCK-TALUS DAMS,
W71-04003 08A

CONCRETE FOR KRASNOLARSK DAM,
W71-04004 08F

DETERMINATION OF SOIL PERMEABILITY BY THE METHOD OF LARGE RINGS,
W71-04006 02G

PRECAST REINFORCED CONCRETE IN HYDRAULIC CONSTRUCTION,
W71-04015 08F

DRAINAGE LINE DEPTH,
W71-04016 08D

SARATOV HYDROELECTRIC POWERPLANT CONSTRUCTION DATA,
W71-04017 08C

BUREAU OF RECLAMATION APPROPRIATION ACTS AND ALLOTMENTS 1966 STATISTICAL SUPPLEMENT.
W71-04103 09D

BUREAU OF RECLAMATION, DENVER, COLO. ENGINEERING AND RESEARCH CENTER.
WATER MEASUREMENT PROCEDURES - IRRIGATION OPERATORS' WORKSHOP.
W71-04007 08B

BUREAU OF RECLAMATION, DENVER, COLO., ENGINEERING AND RESEARCH CENTER.
A GUIDE TO USING INTEREST FACTORS IN ECONOMIC ANALYSIS OF WATER PROJECTS,
W71-04283 06B

BUREAU OF RECLAMATION, WASHINGTON, D.C.
BUREAU OF RECLAMATION APPROPRIATION ACTS AND ALLOTMENTS.
W71-04309 09D

BUREAU OF SPORT FISHERIES AND WILDLIFE, COOK, WASHINGTON. WESTERN FISH NUTRITION LAB.
ACTION OF IRON SALTS IN SOLUTION ON GOLDFISH,
W71-03851 05C

BURMA METEOROLOGICAL DEPT., RANGOON.
SEVERE CYCLONIC STORM RESPONSIBLE FOR FLASH FLOOD IN PAKOKKU AND MONYWA DISTRICTS DURING THE MONTH OF OCTOBER 1967,
W71-04164 02B

LOWER AND MIDDLE IRRAWADDY FLOODS IN RELATION TO HEAVY RAINFALL IN THE HEAD WATER REGIONS OF CHINDWIN AND IRRAWADDY RIVERS,
W71-04165 02E

CAIRO UNIV., GIZA (EGYPT). DEPT. OF BOTANY.
ROOT DEVELOPMENT OF TWO COMMON SPECIES IN DIFFERENT HABITATS IN THE MEDITERRANEAN SUBREGION IN EGYPT,
W71-04300 02I

CALIFORNIA STATE COLL., LONG BEACH. DEPT. OF GEOGRAPHY.
IRRIGATION DEVELOPMENT IN TUNISIA,
W71-04232 03F

CALIFORNIA STATE DEPT. OF WATER RESOURCES, LOS ANGELES. SOUTHERN DISTRICT.
EFFECT OF SOLID WASTE DISPOSAL ON GROUNDWATER QUALITY,
W71-04116 05C

CALIFORNIA STATE DEPT. OF WATER RESOURCES, SACRAMENTO.
WATER, A PROGRESS REPORT.
W71-03905 08A

CALIFORNIA STATE DIV. OF FORESTRY, SACRAMENTO.
ECOLOGICAL SIGNIFICANCE OF ALIEN PLANTS IN CALIFORNIA GRASSLANDS,
W71-04233 04A

CALIFORNIA STATE. DEPT. OF WATER RESOURCES, SACRAMENTO.
RECLAMATION IN THE UNITED STATES,
W71-04306 06C

CALIFORNIA UNIV., BERKELEY.
NEW CHART OFFERS FAST PERMEABILITY ESTIMATE,
W71-04110 07B

CALIFORNIA UNIV., BERKELEY. DEPT. OF CIVIL ENGINEERING.
SEDIMENT TRANSPORT IN DEGRADING RIVERS,
W71-03995 02J

CALIFORNIA UNIV., DAVIS. DEPT. OF ENVIRONMENTAL TOXICOLOGY.
GAS CHROMATOGRAPHIC SEPARATIONS OF MIXED CHLORINATED FUNGICIDES,
W71-04213 05A

CALIFORNIA UNIV., DAVIS. DEPT. OF GEOGRAPHY.
THE LOCATION OF LAND USE TYPES THE NILE VALLEY IN NORTHERN SUDAN,
W71-04228 04A

CALIFORNIA UNIV., DAVIS. DEPT. OF WATER SCIENCE AND ENGINEERING.
A SIMPLE CASCADE WATERSHED MODEL,
W71-04181 02A

CALIFORNIA UNIV., LOS ANGELES.
OPTIMIZATION OF WATER RESOURCE SYSTEMS INCORPORATING EARTHQUAKE RISK PROGRESS REPORT NO 1,
W71-04041 06A

THE EFFECT OF VEGETATION CONVERSION AND FLOOD DISCHARGE ON STREAM CHANNEL GEOMETRY THE CASE OF SOUTHERN CALIFORNIA WATERSHEDS,
W71-04230 04D

CALIFORNIA UNIV., LOS ANGELES. DEPT. OF GEOGRAPHY.
POTENTIAL EVAPOTRANSPIRATION AND THE WATER BALANCE IN WEST AFRICA AN ALTERNATIVE METHOD OF PENMAN,
W71-04063 02D

CALIFORNIA UNIV., LOS ANGELES. SCHOOL OF ENGINEERING AND APPLIED SCIENCE.
OPTIMUM FIRE POWER OUTPUT FROM A TWO RESERVOIR SYSTEM BY INCREMENTAL DYNAMIC PROGRAMMING,
W71-04111 04A

CALIFORNIA UNIV., LOS ANGLES. LAB. OF NUCLEAR MEDICINE AND RADIATION BIOLOGY.
PERENNATION IN ASTRAGALUS LENTIGINOSUS AND TRIDENS PULCHELLUS IN RELATION TO RAINFALL,
W71-04299 02I

CALIFORNIA UNIV., RIVERSIDE. DEPT. OF ENGINEERING AND CALIFORNIA UNIV., LOS ANGELES. DEPT. OF ENGINEERING.
WATER RESOURCES SYSTEMS ENGINEERING,
W71-03885 06A

CALIFORNIA UNIV., RIVERSIDE. DRY-LANDS RESEARCH INST. AND NEW SOUTH WALES UNIV., KENSINGTON. SCHOOL OF CIVIL ENGINEERING.
OPTIMAL ALLOCATION OF STOCHASTIC WATER SUPPLY,
W71-04028 03B

CARIO UNIV., GIZA (EGYPT). FACULTY OF SCIENCE AND MINISTRY OF AGRICULTURE, CAIRO (EGYPT). SOIL RESEARCH DEPT.
FORMATION OF PHYTOGENIC HILLOCKS II. ROOTING HABIT OF PLANTS FORMING PHYTOGENIC HILLOCKS,
W71-04295 02I

CENTRAL WASHINGTON STATE COLL., ELLENSBURG. DEPT. OF

GEOGRAPHY.
THE LAND AND WATER CONSERVATION FUND ACT DEVELOPMENT AND IMPACT,
W71-04097 06E

CHEVRON OIL CO., HOUSTON, TEX.
GLOSSARY OF TERMS USED IN WELL LOGGING,
W71-04113 10

CLARK UNIV., WORCESTER, MASS. GRADUATE SCHOOL OF GEOGRAPHY.
NATURAL HAZARD IN HUMAN ECOLOGICAL PERSPECTIVE HYPOTHESES AND MODELS,
W71-04032 06G

CLEMSON UNIV., S.C. DEPT. OF ENVIRONMENTAL SYSTEMS ENGINEERING.
KINETICS OF FIXED FILM BIOLOGICAL REACTORS,
W71-04085 05D

COLORADO AGRICULTURAL EXPERIMENT STATION, FORT COLLINS.
THE PUMPED WELL,
W71-04292 04B

COLORADO STATE UNIV., FORT COLLINS.
THE IMPACT OF AGRICULTURAL CHANGE ON A LOCAL ECONOMY IN THE GREAT PLAINS,
W71-04289 03F

COLORADO STATE UNIV., FORT COLLINS. DEPT. OF CIVIL ENGINEERING.
ECONOMICS OF THERMAL POLLUTION CONTROL,
W71-04084 05D

COLORADO STATE UNIV., FORT COLLINS. DEPT. OF ECONOMICS AND COLORADO STATE UNIV., FORT COLLINS. DEPT. OF AGRONOMY.
EVALUATION OF IRRIGATION WATER AND NITROGEN FERTILIZER IN CORN PRODUCTION,
W71-04304 03F

COLORADO STATE UNIV., FORT COLLINS. NATURAL RESOURCES CENTER.
IMPROVING EFFICIENCY IN AGRICULTURAL WATER USE,
W71-04049 03C

COLUMBIA UNIV., NEW YORK. STUDIES IN THE SOCIAL SCIENCES.
FEDERAL WATER-POWER LEGISLATION,
W71-04307 06E

COMMISSARIAT A L'ENERGIE ATOMIQUE, SACLAY (FRANCE). CENTRE D'ETUDES NUCLEAIRES.
QUANTITATIVE ASPECTS OF THE STUDY OF WATER BALANCES IN LAKES USING THE DEUTERIUM AND OXYGEN-18 CONCENTRATIONS IN THE WATER, (FRENCH),
W71-04139 02A

COMMITTEE ON PUBLIC WORKS (U. S. SENATE). SUBCOMMITTEE ON FLOOD CONTROL - RIVERS AND HARBORS.
PUBLIC WORKS AUTHORIZATIONS, 1968 - RIVERS AND HARBORS - FLOOD CONTROL AND MULTIPLE PURPOSE PROJECTS - PART I.
W71-04254 06E

HEARINGS BEFORE THE SUBCOMMITTEE ON FLOOD CONTROL - RIVERS AND HARBORS THE COMMITTEE ON PUBLIC WORKS, UNITED STATES SENATE, 90TH CONGRESS, 2ND SESSION.
W71-04255 06E

CONSEJO SUPERIOR DI INVESTIGACIONES CIENTIFICAS, MADRID (SPAIN). INSTITUTO DE HIDROLOGIA.
PRACTICAL METHODS OF ESTIMATING MAXIMUM FLOODS (FRENCH),
W71-03990 02E

CORNELL UNIV., ITHACA, N.Y.
A REVIEW OF THE 1969 LITERATURE ON WASTE WATER AND WATER POLLUTION CONTROL, ADMINISTRATION SYSTEMS ANALYSIS,
W71-03879 05G

CORNELL UNIV., ITHACA, N.Y. WATER RESOURCES AND MARINE SCIENCES CENTER.
EUTROPHICATION OF WATER RESOURCES OF NEW YORK STATE, OBSERVATIONS ON NUTRIENT LIMITATION ON SUMMER PHYTOPLANKTON IN CAYUGA LAKE, 1967 AND 1968,
W71-03923 02H

CORNELL (MAURICE H.) AND ASSOCIATES, MIAMI, FLA.
RECOMMENDATIONS CONCERNING PROPOSED LEGISLATION TO AUTHORIZE WATER MANAGEMENT DISTRICTS IN FLORIDA.
W71-03878 06E

CORPS OF ENGINEERS, CINCINNATI, OHIO. OFFICE OF APPALACHIAN STUDIES.
THE INCIDENCE AND FORMATION OF MINE DRAINAGE POLLUTION - APPENDIX C TO 'REPORT FOR DEVELOPMENT OF WATER RESOURCES OF APPALACHIA'.
W71-03872 05B

CORPS OF ENGINEERS, DAVIS, CALIF. HYDROLOGIC ENGINEERING CENTER.
PROCEEDINGS OF A SEMINAR ON RESERVOIR SYSTEMS ANALYSIS, 4-6 NOVEMBER 1969.
W71-04034 04A

CORPS OF ENGINEERS, SACRAMENTO, CALIF.
FLOOD PLAIN INFORMATION, TRUCKEE RIVER, RENO-SPARKS-TRUCKEE MEADOWS, NEVADA.
W71-04144 04A

FLOOD PLAIN INFORMATION, BURCH CREEK, OGDEN, UTAH.
W71-04145 04A

COUNCIL OF STATE GOVERNMENTS, ATLANTA, GA. SOUTHERN OFFICE.
THE POLITICS OF WATER,
W71-04091 06E

DEBELL AND RICHARDSON, INC., HAZARDVILLE, CONN.
POROUS TUBULET SUPPORTS FOR DESALINATION BARRIERS,
W71-03911 03A

DEERING MILLIKEN RESEARCH CORP., SPARTANBURG, S.C. AND CLEMSON UNIV., S.C.
MULTI-STAGE BIOLOGICAL PROCESSES FOR WASTE TREATMENT,
W71-03894 05D

DELAWARE RIVER BASIN COMMISSION, TRENTON, N.J.
RULES OF PRACTICE AND PROCEDURE.
W71-04327 06E

DENVER BOARD OF WATER COMMISSIONERS, COLO.
STUDY OF MOLYBDENUM IN PUBLIC WATER SUPPLY,
W71-04120 05A

DEPARTMENT OF ENERGY, MINES AND RESOURCES, CALGARY (ALBERTA). INLAND WATERS BRANCH AND RESEARCH COUNCIL OF ALBERTA, EDMONTON.
GEOHYDROLOGIC BOUNDARY ENVELOPES,
W71-04125 02F

DESERT INST., ASHKHABAD (USSR).
PROGRESS IN WATER DESALINATION TECHNOLOGY,
W71-04229 03A

DRAINAGE AND IRRIGATION DEPT., KUALA LUMPUR (MALAYSIA). RESEARCH STATION.
THE PROBLEM OF FLOOD PREDICTION ON THE EAST COAST OF WEST MALAYSIA,
W71-04167 02B

DUM DUM AIRPORT, CALCUTTA (INDIA) AND METEOROLOGICAL OFFICE, NEW DELHI (INDIA).
EVALUATION OF MAXIMUM RAINFALL DISCHARGE FROM A REGION OF DEFICIENT RAINFALL DATA,
W71-03978 02E

EAST PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY, DACCA.
MAXIMUM DISCHARGE OF MAJOR RIVERS IN LARGE FLOOD PLAINS IN EAST PAKISTAN,
W71-03986 02E

ECONOMIC COMMISSION FOR ASIA AND THE FAR EAST (UN), NEW YORK.
ENVELOPE-FREQUENCY RELATIONS FOR MAXIMUM FLOODS IN MONSOON AREAS OF THE ECAFE REGION.
W71-04117 02B

ECONOMIC RESEARCH SERVICE, FARGO, N. DAK.
AN ECONOMIC ANALYSIS OF LEVEL BENCH SYSTEMS FOR FORAGE PRODUCTION IN NORTH DAKOTA,
W71-04265 03F

ECONOMIC RESEARCH SERVICE, WASHINGTON, D.C. NATURAL RESOURCE ECONOMICS DIV. AND OKLAHOMA STATE UNIV. STILLWATER. DEPT. OF AGRICULTURAL ECONOMICS.
USING COMPUTERS TO HELP EVALUATE FLOOD PROTECTION MEASURES,
W71-04293 07C

ELECTRICITE DE FRANCE, CHATOU. CENTRE DE RECHERCHES ET D'ESSAIS.
DETERMINATION OF MAXIMUM FLOOD FLOW AND THE PROBABILITY OF ITS BEING EXCEEDED, USING INCOMPLETE INFORMATION (FRENCH),
W71-03979 02E

ENGINEERING SCIENCE, INC., OAKLAND, CALIF. AND GENERAL BEHAVIORAL SYSTEMS, LOS ANGELES, CALIF.
APPLICATION OF INDUSTRIAL DYNAMICS CONCEPTS TO DECISION MAKING IN ENVIRONMENTAL MANAGEMENT,
W71-04025 05G

ENGINEERING-SCIENCE, INC., ARCADIA, CALIF.
EFFECTS OF WASTE DISPOSAL INTO MARINE WATERS - A SURVEY OF STUDIES CARRIED OUT IN THE LAST TEN YEARS,
W71-04114 05C

FARMERS HOME ADMINISTRATION, CHAMPAIGN, ILL.
DESIGN CONSTRUCTION AND MAINTENANCE OF WASTE STABILIZATION LAGOONS,
W71-03896 05D

FEDERAL COUNCIL FOR SCIENCE AND TECHNOLOGY, WASHINGTON, D.C.
FEDERAL WATER RESOURCES RESEARCH ACTIVITIES.
W71-04105 06E

FEDERAL WATER POLLUTION CONTROL ADMINISTRATION, CINCINNATI, OHIO. ANALYTICAL QUALITY CONTROL LAB.
REARING DEVICES FOR STREAM INSECT LARVAE,
W71-04190 07B

EVALUATION REPORT 1 AUTOMATIC BEAKER SAMPLE CHANGER,
W71-04192 07B

A NEW FRESHWATER CENTRIC DIATOM MICROSIPHONA POTAMOS GEN. ET SP. NOV.,
W71-04193 05C

USE OF A FLOATING PERIPHYTON SAMPLER FOR WATER POLLUTION SURVEILLANCE,
W71-04194 05B

ELIMINATION OF 'MEMORY' PEAKS ENCOUNTERED IN AQUEOUS-INJECTION GAS CHROMATOGRAPHY,
W71-04196 07B

LABORATORY GUIDE FOR THE IDENTIFICATION ON PETROLEUM PRODUCTS,

W71-04199 05A

FWPCA METHOD STUDY 1 MINERAL AND PHYSICAL ANALYSES - AN EVALUATION OF FWPCA ANALYTICAL METHODS FOR SURFACE WATERS,
W71-04200 05A

PESTICIDES IN SURFACE WATERS OF THE UNITED STATES A FIVE-YEAR SUMMARY 1964-1968,
W71-04201 05A

FWPCA METHODS FOR CHEMICAL ANALSIS OF WATER AND WASTES.
W71-04202 05A

METHOD SELECTION STUDY 1 A COMPARISON OF THREE MODIFICATIONS OF THE SINGLE REAGENT METHOD FOR SOLUBLE ORTHOPHOSPHATE,
W71-04204 05A

ANALYTICAL INSTRUMENTS IN WATER POLLUTION CONTROL,
W71-04205 05A

PERIPHYTON BIOMASS-CHLOROPHYLL RATIO AS AN INDEX OF WATER QUALITY,
W71-04206 05A

FEDERAL WATER POLLUTION CONTROL ADMINISTRATION, CINCINNATI, OHIO.
THE PRESERVATION OF PHYTOPLANKTON GRAB SAMPLES,
W71-04207 05A

FEDERAL WATER POLLUTION CONTROL ADMINISTRATION, CINCINNATI, OHIO. DIV. OF POLLUTION SURVEILLANCE.
USING MACROINVERTEBRATE COLLECTIONS FOR WATER QUALITY MONITORING IN THE OHIO RIVER BASIN 1963-1966,
W71-04208 05C

FEDERAL WATER POLLUTION CONTROL ADMINISTRATION, CINCINNATI, OHIO.
PHYTOPLANKTON, SESTON, AND DISSOLVED ORGANIC CARBON IN THE LITTLE MIAMI RIVER AT CINCINNATI, OHIO,
W71-04209 05A

FEDERAL WATER POLLUTION CONTROL ADMINISTRATION, CINCINNATI, OHIO. DIV. OF POLLUTION SURVEILLANCE.
A GUIDE TO THE COMMON DIATOMS AT WATER POLLUTION SURVEILLANCE SYSTEM STATIONS,
W71-04210 07C

FEDERAL WATER POLLUTION CONTROL ADMINISTRATION, CINCINNATI, OHIO.
A STUDY OF PHOTOSYNTHESIS IN CLEAR LAKE, IOWA,
W71-04212 05C

FEDERAL WATER POLLUTION CONTROL ADMINISTRATION, CINCINNATI, OHIO. DIV. OF POLLUTION SURVEILLANCE.
MICRODETERMINATION OF DERIVATIVES OF PHENOLS AND MERCAPTANS BY MEANS OF ELECTRON CAPTURE GAS CHROMATOGRAPHY,
W71-04218 05A

FEDERAL WATER POLLUTION CONTROL ADMINISTRATION, CINCINNATI, OHIO.
A LIMESTONE-FILLED, ARTIFICIAL SUBSTRATE SAMPLER-FLOAT UNIT FOR COLLECTING MACROINVERTEBRATES IN LARGE STREAMS,
W71-04219 07B

FEDERAL WATER QUALITY ADMINISTRATION, CINCINNATI, OHIO.
STREAM POLLUTION BY COAL MINE DRAINAGE IN APPALACHIA.
W71-03873 05B

FEDERAL WATER QUALITY ADMINISTRATION, CINCINNATI, OHIO. ANALYTICAL QUALITY CONTROL LAB.
ARTIFICIAL SUBSTRATE SAMPLING, MACROINVERTEBRATES IN A POLLUTED REACH OF THE KLAMATH RIVER, OREGON,
W71-04191 05A

METHODS OF COLLECTION AND ANALYSIS OF PLANKTON AND PERIPHYTON SAMPLES IN THE WATER POLLUTION SURVEILLANCE SYSTEM,
W71-04195 05A

FEDERAL WATER QUALITY ADMINISTRATION, WASHINGTON, D.C. DIV. OF APPLIED SCIENCE AND TECHNOLOGY AND GEOLOGICAL SURVEY, WASHINGTON, D.C.
An OVERVIEW OF U.S. DEPARTMENT OF INTERIOR'S ROLE IN SEDIMENT CONTROL,
W71-04147 04D

FLORIDA UNIV., GAINESVILLE. DEPT. OF CHEMICAL ENGINEERING AND FLORIDA UNIV., GAINESVILLE. DEPT. OF ANESTHESIOLOGY.
STRUCTURE OF WATER IN MICROEMULSIONS ELECTRICAL, BIREFRINGENCE, AND NUCLEAR MAGNETIC RESONANCE STUDIES,
W71-04108 01B

FLORIDA UNIV., GAINESVILLE. DEPT. OF ECONOMICS.
STRUCTURE OF PUBLICLY-OWNED WATER UTILITIES,
W71-04281 06E

FLORIDA UNIV., GAINSVILLE. DEPT. OF ENVIRONMENTAL ENGINEERING.
PREDICTION OF SOLAR AND ATMOSPHERIC RADIATION FOR ENERGY BUDGET STUDIES OF LAKES AND STREAMS,
W71-04020 02B

FLUOR CORP. LTD., LOS ANGELES, CALIF.
EVALUATION OF THE VERTICAL TUBE EVAPORATOR AND THE MULTISTAGE FLASH DESALINATION PROCESSES.
W71-03913 03A

FOREST SERVICE (USDA), ALBUQUERQUE, N. MEX. ROCKY MOUNTAIN FOREST AND RANGE EXPERIMENT STATION.
FOURWING SALTBUSH CAN BE FIELD PLANTED SUCCESSFULLY,
W71-04247 04A

FOREST SERVICE (USDA), BERKELEY, CALIF. PACIFIC SOUTHWEST FOREST AND RANGE EXPERIMENT STATION.
WETTING AGENT FAILS TO CURB EROSION FROM BURNED WATERSHED,
W71-04250 04D

FOREST SERVICE (USDA), FAYETTEVILLE, ARK. SOUTHERN FOREST EXPERIMENT STATION.
HALF-MINUTE COUNTS FOR NEUTRON PROBES,
W71-04259 07B

FOREST SERVICE (USDA), FORT COLLINS, COLO. ROCKY MOUNTAIN FOREST AND RANGE EXPERIMENT STATION.
ARTILLERY CONTROL OF AVALANCHES ALONG MOUNTAIN HIGHWAYS,
W71-04258 02C

FOREST SERVICE (USDA), LARAMIE, WYO. ROCKY MOUNTAIN FOREST AND RANGE EXPERIMENT STATION.
THE HYDROLOGY OF SAGEBRUSH LANDS AND THE MANAGEMENT OF BLOWING SNOW,
W71-04248 03B

SUMMARY OF SNOW RESEARCH BY THE ROCKY MOUNTAIN FOREST AND RANGE EXPERIMENT STATION AT LARAMIE, WYOMING.,
W71-04249 02C

FOREST SERVICE (USDA), LOGAN, UTAH. INTERMOUNTAIN FOREST AND RANGE EXPERIMENT STATION.
MEASUREMENT OF WATER POTENTIAL WITH THERMOCOUPLE PSYCHROMETERS CONSTRUCTION AND APPLICATIONS,
W71-04237 02I

WATER POTENTIAL MEASUREMENTS IN TRESS,
W71-04238 02I

LEAF SAMPLER FOR RELATIVE WATER CONTENT MEASUREMENTS DESIGN AND APPLICATION,
W71-04239 02I

WATERSHED MANAGEMENT IN THE UNITED STATES CONCEPTS AND PRINCIPLES,
W71-04253 03B

FOREST SERVICE (USDA), OGDEN, UTAH. INTERMOUNTAIN FOREST AND RANGE EXPERIMENT STATION.
ASPEN SPROUT PRODUCTION AND WATER USE,
W71-04241 02I

SOIL MOISTURE DEPLETION AND ESTIMATED EVAPOTRANSPIRATION ON UTAH MOUNTAIN WATERSHED,
W71-04242 02D

SOIL FREEZING DETERMINED WITH FOUR TYPES OF WATER-FILLED TUBES,
W71-04251 07B

DO CONTOUR TRENCHES REDUCE WET-MANTLE FLOOD PEAKS,
W71-04262 04A

INFILTRATION IN CONTOUR TRENCHES IN THE SIERRA NEVADA,
W71-04263 04A

VERIFYING RECORDING PRECIPITATION GAUGE RECORDS,
W71-04264 07C

FOREST SERVICE (USDA), PORTLAND, OREG. PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION.
INCREASES IN WATER YIELD FOLLOWING CLEAR-CUT LOGGING IN THE PACIFIC NORTHWEST,
W71-04240 03B

FOREST SERVICE (USDA), RENO, NEV. INTERMOUNTAIN FOREST AND RANGE EXPERIMENT STATION.
INFILTRATION AND SOIL EROSION AS INFLUENCED BY VEGETATION AND SOIL IN NORTHERN UTAH,
W71-04260 02J

INFILTRATION AND SOIL EROSION ON COOLWATER RIDGE, IDAHO,
W71-04261 02J

FOREST SERVICE (USDA), UPPER DARBY, PA. NORTHEASTERN FOREST EXPERIMENT STATION.
THE MANAGEMENT OF FORESTED WATERSHEDS FOR DOMESTIC WATER SUPPLIES,
W71-04244 06A

GENERAL ANILINE AND FILM CORP., GREENWICH, CONN. INDUSTRIAL PRODUCTS DIV.
FABRICATION OF FELT-MEMBRANE COMPOSITES,
W71-04222 03A

GEOLOGICAL SURVEY OF INDIA, CALCUTTA. MARINE GEOLOGY UNIT.
A MECHANICAL DEVICE FOR RELEASING FLUORESCENT TRACERS,
W71-03949 07B

GEOLOGICAL SURVEY, ALBANY, N.Y.
A PROPOSED STREAMFLOW DATA PROGRAM FOR NEW YORK,
W71-03933 07A

GEOLOGICAL SURVEY, ARLINGTON, VA.
COST OF PATUXENT RIVER QUALITY MONITORING,
W71-04115 05A

GEOLOGICAL SURVEY, AUSTIN, TEX.
GROUNDWATER RESOURCES OF COLLINGSWORTH COUNTY, TEXAS,
W71-03935 02F

GEOLOGICAL SURVEY, IOWA CITY, IOWA.
FLOOD PROFILE STUDY, HOOSIER CREEK, LINN COUNTY, IOWA,
W71-03932 02E

GEOLOGICAL SURVEY, RALEIGH, N.C.
MOVEMENT OF AGRICULTURAL POLLUTANTS WITH GROUNDWATER,
W71-04121 05B

GEOLOGICAL SURVEY, SALT LAKE CITY, UTAH.
WATER-QUALITY DATA FOR THE FLAMING GORGE RESERVOIR AREA, UTAH AND WYOMING,
W71-03936 07C

GEOLOGICAL SURVEY, TACOMA, WASH.
AVAILABILITY OF GROUNDWATER IN WESTERN COWLITZ COUNTY, WASHINGTON,
W71-03934 02F

GEOLOGICAL SURVEY, WASHINGTON, D.C.
REPLY,
W71-04035 06B

QUALITY OF SURFACE WATERS OF THE UNITED STATES, 1965 PARTS 7 AND 8. LOWER MISSISSIPPI RIVER BASIN AND WESTERN GULF OF MEXICO BASINS.
W71-04048 02K

GEOLOGICAL SURVEY, WASHINGTON, D.C. OFFICE OF WATER DATA COORDINATION.
CATALOG OF INFORMATION ON WATER DATA, EDITION 1970 - INDEX TO WATER QUALITY SECTION.
W71-04150 07C

CATALOG OF INFORMATION ON WATER DATA, EDITION 1970-INDEX TO SURFACE WATER SECTION.
W71-04151 07C

GESELLSCHAFT FUER STRAHLENFORSCHUNG M.B.H., MUNICH (WEST GERMANY). INSTITUT FUER RADIOHYDROMETRIE.
DEUTERIUM MEASUREMENTS ON SNOW SAMPLES FROM THE ALPS,
W71-04136 02A

GESELLSCHAFT ZUR WIEDERAUFARBEITUNG VON KERNBRENNSTOFFEN M.B.H., MANNHEIM (WEST GERMANY) AND WISCONSIN UNIV., MADISON. DEPT. OF CIVIL ENGINEERING.
DESIGN CAPACITIES TO ACCOMMODATE FORECAST UNDERTAINTIES,
W71-04026 06A

GIDROMETEOROLOGICHESKII NAUCHNO-ISSLEDOVATELSKII TSENTR, MOSCOW (USSR).
CALCULATION OF FLOOD WAVES FOR A LARGE RIVER SYSTEM,
W71-04176 02E

GRACE (W. R.) AND CLARKSVILLE, MD.
CHEMICAL EXFOLIATED VERMICULITE FOR REMOVAL OF PHOSPHATE FROM WASTE WATERS,
W71-04107 05D

GRENOBLE UNIV. (FRANCE).
EVALUATION OF MAXIMUM FLOW OF FLOODS USING PRECIPITATION DATA (FRENCH),
W71-03983 02A

GUELPH UNIV. (ONTARIO). SCHOOL OF AGRICULTURAL ENGINEERING AND CESKOSLOVENSKA AKADEMIE VED, PRAGUE. INST. OF HYDRODYNAMICS.
DERIVATION OF A GENERAL FLOOD WAVE HYDROGRAPH FROM A CONTINUOUS WATERSHED WATER BALANCE,
W71-03989 02E

GULF GENERAL ATOMIC, SAN DIEGO, CALIF.
MEMBRANE MATERIALS FOR WASTE WATER RECLAMATION BY REVERSE OSMOSIS,
W71-04185 05D

HARVARD UNIV., CAMBRIDGE, MASS.
COMMENTS ON 'THE LINEAR DECISION RULE IN RESERVOIR MANAGEMENT AND DECISION RULE IN RESERVOIR MANAGEMENT AND DESIGN' BY CHARLES REVELLE, ERHARD JOERES AND WILLIAM KIRBY,
W71-04029 06B

HAWAII UNIV., HONOLULU. DEPT. OF AGRONOMY AND SOIL SCIENCE.
SOLUBILITY AND AVAILABILITY OF SORBED SULFATE IN HAWAIIAN SOILS,
W71-03941 02G

HAWAII UNIV., HONOLULU. PACIFIC BIOMEDICAL RESEARCH CENTER.
RESPONSES OF NATIVE AND MIGRANT DESERT RESIDENTS TO ARID HEAT,
W71-04301 02I

HEBREW UNIV., JERUSALEM (ISRAEL).
THE DEVELOPMENT OF EGGS OF THE RED LOCUST NOMADACRIS SEPTEMFASCIATA (SERV.), AND THE AFRICAN MIGRATORY LOCUST, LOCUSTA MIGRATORIA MIGRATORIODES (R. AND F.), AND ITS INTERRUPTION UNDER PARTICULAR CONDITIONS OF HUMIDITY,
W71-04297 03F

HEIDELBERG UNIV. (WEST GERMANY). PHYSIKALISCHES INSTITUT (II).
STABLE ISOTOPES IN STUDY OF WATER BALANCE OF LAKE NEUSIEDL, AUSTRIA INVESTIGATION OF THE RELIABILITY OF THE STABLE ISOTOPE METHOD,
W71-04141 02A

HITTMAN ASSOCIATES, INC., COLUMBIA, MD.
REVERSE OSMOSIS DESALTING STATE-OF-THE-ART (1969).
W71-04225 03A

HORIZONS, INC, CLEVELAND, OHIO.
TREATMENT OF ACID MINE DRAINAGE BY FOAM SEPARATION,
W71-04188 05D

HYDROGRAPHIC OFFICE OF THE PO RIVER, PARMA (ITALY).
PROBABLE FLOOD DISCHARGES OF THE PO RIVER TRIBUTARIES,
W71-03987 02E

ICELAND UNIV., REYKJAVIK. SCIENCE INST.
EXCHANGE OF DEUTERIUM BETWEEN ICE AND WATER IN GLACIOLOGICAL STUDIES IN ICELAND,
W71-04137 02A

ILLINOIS STATE WATER SURVEY, URBANA.
TOOLS FOR WATER-RESOURCE STUDY,
W71-04027 06A

ILLINOIS UNIV., URBANA.
ANALYSIS OF STOCHASTIC HYDROLOGIC SYSTEMS,
W71-03869 02A

ILLINOIS UNIV., URBANA. DEPT. OF GEOLOGY.
DEPOSITIONAL AND DISPERSAL DYNAMICS OF INTERTIDAL SAND BARS,
W71-03948 02J

ILLINOIS UNIV., URBANA. DEPT. OF METALLURGY AND MINING ENGINEERING.
CHAIN MODEL OF RIVER MEANDERS,
W71-04124 02E

IMPERIAL CHEMICAL INDUSTRIES LTD., BRIXHAM (ENGLAND). BRIXHAM RESEARCH LAB.
HIGH-RATE BIOFILTRATION PAST AND FUTURE,
W71-04076 05D

INDIAN INST. OF SCIENCE, BANGALORE. DEPT. OF CIVIL AND HYDRAULIC ENGINEERING.
THE UNIVERSALISATION OF THE CO-ORDINATES OF LOGARITHMIC WEIR PROFILES,
W71-04127 07B

EXPERIMENTAL STUDIES ON LINEAR PROPORTIONAL WEIRS WITH TRIANGULAR BOTTOMS,
W71-04129 08B

INDIANA UNIV., BLOOMINGTON. DEPT. OF GEOGRAPHY AND OREGON STATE UNIV., CORNWALLIS. DEPT. OF CIVIL ENGINEERING.
THE INFLUENCE OF LANDFORM AND PRECIPITATION PARAMETERS ON FLOOD HYDROGRAPHS,
W71-03871 02E

INDIANA UNIV., BLOOMINGTON. DEPT. OF POLITICAL SCIENCE.
CONDITIONS OF LEGAL AND POLITICAL FEASIBILITY,
W71-03866 06E

INDIANA UNIV., BLOOMINGTON. SCHOOL OF LAW.
THE LEGAL SYSTEM STRUCTURE OR CONSTRAINT FOR SYSTEMS ANALYSIS DECISION-MAKING,
W71-03865 06E

INTERNATIONAL ATOMIC ENERGY AGENCY, VIENNA (AUSTRIA) AND HYDRAULIC RESEARCH INST., PRAGUE (CZECHOSLOVAKIA).
VARIATION OF THE TRITIUM AND OXYGEN-18 CONTENT IN PRECIPITATION AND SNOWPACK IN A REPRESENTATIVE BASIN IN CZECHOSLOVAKIA,
W71-04135 02A

INTERNATIONAL ATOMIC ENERGY AGENCY, VIENNA (AUSTRIA).
ISOTOPE HYDROLOGY, 1970.
W71-04133 02A

IOWA STATE UNIV., AMES. DEPT. OF CIVIL ENGINEERING.
INTERACTION AMONG NATURAL RESOURCE SYSTEMS, THE DECISION MAKERS AND THE PUBLIC IN THE 2000'S,
W71-03868 06B

IOWA UNIV., IOWA CITY. INST. OF URBAN AND RURAL RESEARCH IOWA UNIV., IOWA CITY. DEPT. OF GEOGRAPHY AND NORTHERN ILLINOIS UNIV., DE KALB. DEPT. OF GEOGRAPHY.
SPATIAL PATTERNS OF SOCIO-ECONOMIC STRUCTURE IN INDIA,
W71-04234 06B

ISLAND CREEK COAL CO., HOLDEN, W. VA. ISLAND CREEK DIV AND NUS CORP., PITTSBURGH, PA. CYRUS WM. RICE DIV.
FEASIBILITY STUDY OF MINING COAL IN AN OXYGEN FREE ATMOSPHERE.
W71-04187 05G

JAPAN METEOROLOGICAL AGENCY, TOKYO.
SOME EXAMPLES OF HEAVY RAINFALL IN JAPAN,
W71-04166 02B

JAPAN METEOROLOGICAL AGENCY, TOKYO. FORECAST SECTION.
PREDICTION OF FLOODS FROM HEAVY RAINFALL,
W71-04159 02E

JOHANNESBURG CITY ENGINEER'S DEPT. (SOUTH AFRICA).
A LONG-TERM PLAN FOR SEWERAGE DEVELOPMENT IN THE JOHANNESBURG REGION,
W71-03895 05G

KANSAS STATE COLL. OF PITTSBURG. DEPT. OF GEOGRAPHY.
WATER TABLE DECLINE AND RESULTANT AGRICULTURAL PATTERNS IN THE SALT RIVER VALLEY OF ARIZONA,
W71-04065 03F

KANSAS STATE GEOLOGICAL SURVEY, LAWRENCE.
GEOLOGY AND GROUNDWATER RESOURCES OF ALLEN COUNTY, KANSAS,
W71-03937 02F

KANSAS STATE UNIV., MANHATTAN. DEPT. OF INDUSTRIAL ENGINEERING.
APPLYING GRADIENT PROJECTION AND CONJUGATE GRADIENT TO THE OPTIMUM OPERATION OF RESERVOIRS,
W71-04030 04A

MODELING AND OPTIMIZATION OF WATER RESOURCES SYSTEMS - PHASE I,
W71-04043 06A

A NONLINEAR MULTIPLE RESERVOIR WATER RESOURCES MODEL WITH MULTIPLE PURPOSES,
W71-04044 04A

STREAM QUALITY MODELING BY QUASILINEARIZATION,
W71-04045 05F

OPTIMUM OPERATION OF MULTIPLE RESERVOIRS WITH MULTIPLE PURPOSES,
W71-04046 04A

OPTIMIZATION OF WATER RESOURCES SYSTEMS BY THE GRADIENT PROJECTION METHOD,
W71-04047 06A

KANSAS UNIV., LAWRENCE.
INSURING MAXIMUM BENEFICIAL USE OF WATER THROUGH LEGISLATION,
W71-04099 06E

KENTUCKY DEPT. OF NATURAL RESOURCES, FRANKFORT.
KENTUCKY WATER RESOURCES 1965 (SUMMARY OF INFORMATION INVOLVING KENTUCKY'S WATER RESOURCES).
W71-04021 06E

KENTUCKY UNIV., LEXINGTON.
A GEOCHEMICAL TREND IN SILICON-ALUMINUM-IRON RATIOS AND THE CLASSIFICATION OF CLASTIC SEDIMENTS,
W71-03945 02K

KENTUCKY UNIV., LEXINGTON. DEPT. OF AGRONOMY.
THE DIFFUSION OF COPPER, MANGANESE, AND ZINC AS AFFECTED BY CONCENTRATION, CLAY MINERALOGY, AND ASSOCIATED ANIONS,
W71-03942 02G

KENTUCKY UNIV., LEXINGTON. DEPT. OF CIVIL ENGINEERING.
INCORPORATING SOCIAL OBJECTIVES IN SYSTEMS MODELS,
W71-03862 06B

LEEDS UNIV. (ENGLAND). DEPT. OF AGRICULTURAL ECONOMICS.
NEW APPROACHES TO IRRIGATED FARMING IN THE SUDAN ORGANIZATION AND MANAGEMENT,
W71-04231 03F

LEGISLATIVE RESEARCH COUNCIL OF MASSACHUSETTS.
RIGHTS TO SURFACE AND SUBSURFACE WATER IN MASSACHUSETTS.
W71-03882 06E

LIBRARY OF CONGRESS, WASHINGTON, D.C. LEGISLATIVE REFERENCE SERVICE.
A NATIONAL POLICY FOR THE ENVIRONMENT SELECTED EXCERPTS FROM THE CONGRESSIONAL RECORD AND CONGRESSIONAL DOCUMENTS, FALL, 1969, 91ST CONGRESS. 1ST SESSION.
W71-04092 06E

LOCKHEED MISSILES AND SPACE CO., SAN DIEGO, CALIF. OCEAN LAB.
EMPIRICAL RELATIONSHIPS BETWEEN MASS PHYSICAL PROPERTIES FOR RECENT MARINE SEDIMENTS OFF SOUTHERN CALIFORNIA,
W71-03951 02J

LOS ANGELES BUREAU OF ENGINEERING, CALIF.
1939 RUNOFF INSTRUCTIONS FOR DESIGN OF STORM DRAINS, OFFICE STANDARD NO. 71.
W71-03906 08A

LOUISIANA STATE UNIV., BATON ROUGE.
EFFECT OF DISPERSION, GRAVITATIONAL SEGREGATION, AND FORMATION STRATIFICATION ON THE RECOVERY OF FRESHWATER STORED IN SALINE AQUIFERS,
W71-03870 02F

MAINE UNIV, WALPOLE, IRA C. DARLING CENTER FOR RESEARCH, TEACHING AND SERVICE.
WATER QUALITY - BENTHIC INVERTEBRATE RELATIONSHIPS IN ESTUARIES,
W71-03922 05C

MAKERERE UNIV., COLL., KAMPALA (UGANDA). DEPT. OF ZOOLOGY.
ENVIRONMENTAL CONTROL OF COLORATION IN AN ACRIDID, GASTRIMARGUS AFRICANUS (SAUSSURE),
W71-04302 03F

MARYLAND DEPT. OF CHESAPEAKE BAY AFFAIRS, ANNAPOLIS AND MARYLAND UNIV., COLLEGE PARK. DEPT. OF AGRICULTURAL ECONOMICS.
ECONOMIC ANALYSIS OF MARINAS IN MARYLAND,
W71-04267 06D

MARYLAND UNIV., BALTIMORE. SCHOOL OF LAW.
CHESAPEAKE BAY IN LEGAL PERSPECTIVE,
W71-04337 06E

MARYLAND UNIV., COLLEGE PARK. DEPT. OF CIVIL ENGINEERING.
DESIGN OF ACTIVATED CARBON ADSORPTION BEDS,
W71-03897 05D

MASONITE CORP., CHICAGO, ILL.
SPRAY IRRIGATION OF WASTES FROM THE MANUFACTURE OF HARDBOARD,
W71-03886 05D

MASS UNIV., AMHERST. WATER RESOURCES RESEARCH CENTER.
OPTIMUM UTILIZATION AND MANAGEMENT OF WATER BEARING FORMATIONS HYDRAULICALLY CONNECTED TO A STRETCH OF THE CONNECTICUT RIVER,
W71-03919 04B

MASSACHUSETTS INST. OF TECH., CAMBRIDGE. URBAN SYSTEMS LAB.
MATHEMATICAL PROGRAMMING APPLICATIONS TO WATER QUALITY PLANNING FOR THE BOSTON HARBOR REGION,
W71-04036 05G

MASSACHUSETTS UNIV., AMHERST. WATER RESOURCES RESEARCH CENTER.
THE ROLE OF AQUATIC VASCULAR PLANTS IN THE EUTROPHICATION OF SELECTED LAKES IN WASTERN MASSACHUSETTS,
W71-03918 05C

MELLON INST., PITTSBURGH, PA. AND VIRGINIA STATE WATER CONTROL BOARD, RICHMOND.
A CASE STUDY OF MICROORGANIC CONTAMINANTS IN RIVER WATER,
W71-04119 05A

MEMORIAL UNIV. OF NEWFOUNDLAND, ST. JOHN'S. DEPT OF GEOGRAPHY.
ASPECTS OF THE SOUTH AUSTRALIAN CITRUS INDUSTRY,
W71-04051 03F

METCALF AND EDDY, INC., PALO ALTO, CALIF.
AN ECONOMIC EVALUATION OF THE WATER QUALITY ASPECTS OF CONTRA COSTA COUNTY'S OFFSHORE WATER SUPPLY.
W71-03909 06B

THE ECONOMIC IMPACT OF ALTERNATIVE WATER CONDITIONS, A REPORT TO THE CONTRA COSTA COUNTY WATER AGENCY.
W71-03910 06B

METEOROLOGICAL OFFICE, NEW DELHI (INDIA).
DETERMINATION OF THE DISTRIBUTION OF RAINFALL FLOODS IN LARGE CATCHMENTS USING HYDROMETEOROLOGICAL DATA,
W71-03977 02E

METEOROLOGICAL OFFICE, POONA (INDIA).
QUANTITATIVE REGIONAL PREDICTION OF RAINFALL IN ECAFE REGIONS,
W71-04152 02B

VERTICAL VELOCITY AND RAINFALL COMPUTATION,
W71-04153 02B

METEOROLOGISCHER DIENST DER DEUTSCHEN DEMOKRATISCHEN REPUBLIK, BERLIN. FORSCHUNGSINSTITUT FUER HYDROMETEOROLOGIE.
ESTIMATION OF THE WATER SUPPLY FROM SNOW COVER IN THE SOUTHERN PART OF THE GERMAN D. R. IN SPRING 1965,
W71-04180 02C

METEOROLOGISCHER DIENST DER DEUTSCHEN DEMOKRATISCHES REPUBLIK, HALLE. AMT FUER METEOROLOGIE.
SOME RESULTS OF INVESTIGATION AND REPRESENTATION OF SNOW SUPPLY AND THE MELTING OF SNOW,
W71-04174 02C

MIAMI UNIV., CORAL GABLES, FLA. DEPT. OF PHARMACOLOGY.
THE ELECTRON CAPTURE DETECTOR IN THE ANALYSIS OF CHLORINATED HYDROCARBON PESTICIDES IN TISSUES WITH AND WITHOUT CLEAN-UP,
W71-04214 05A

MICHIGAN TECHNOLOGICAL UNIV., HOUGHTON. DEPT. OF CIVIL ENGINEERING.
WASTE WATER RESULTING FROM THE CONCENTRATION OF LOW GRADE IRON ORE,
W71-04083 05D

MICHIGAN UNIV., ANN ARBOR. DEPT. OF CIVIL ENGINEERING.
PREDATOR-PREY RELATIONSHIPS IN A MODEL FOR THE ACTIVATED PROCESS,
W71-04070 05D

MICHIGAN UNIV., ANN ARBOR. INST. OF SCIENCE AND TECHNOLOGY.
ESTIMATION OF SEA SURFACE TEMPERATURE FROM SPACE,
W71-03959 07B

MICHIGAN UNIV., ANN ARBOR. SCHOOL OF PUBLIC HEALTH.
SYSTEMS ANALYSIS FOR WATER SUPPLY AND POLLUTION CONTROL,
W71-03857 06A

MICHIGAN WATER RESOURCES COMMISSION, LANSING. DEPT. OF NATURAL RESOURCES.
ECORSE RIVER WATER QUALITY STUDY, MAY-JULY, 1969.
W71-03907 05B

GREAT LAKES SHORELAND MANAGEMENT AND EROSION DAMAGE CONTROL FOR MICHIGAN.
W71-03908 02H

MIDDLEBURY COLL., VT. DEPT. OF GEOGRAPHY.
A NEW APPROACH TO THE CLASSIFICATION OF CLIMATE,
W71-04235 02B

MINISTRY OF WORKS, WELLINGTON (NEW ZEALAND). WATER AND SOIL DIV.
THE RELATIONSHIP BETWEEN SUMMER LOW FLOWS AND GEOLOGY IN NORTHLAND, NEW ZEALAND,
W71-03931 02A

MINNESOTA UNIV., MINNEAPOLIS. ST. ANTHONY FALLS HYDRAULIC LAB.
INVESTIGATION OF AIRFIELD DRAINAGE ARCTIC AND SUBARCTIC REGIONS, SUPPLEMENT TO PART I, FIELD RECONNAISSANCE AND ANALYSIS,
W71-04002 04A

MINNESOTA UNIV., MINNEAPOLIS. WATER RESOURCES RESEARCH CENTER.
THE WORLD OF WATER,
W71-04118 02A

MISSOURI AGRICULTURAL EXPERIMENT STATION, COLUMBIA.
WATER-USE LAW IN MISSOURI,
W71-04339 06E

MISSOURI UNIV., COLUMBIA. DEPT. OF CHEMISTRY.
SPECTROPHOTOMETRIC DETERMINATION OF THIOCYANATE AND OXALATE,
W71-03928 05A

SPECTROPHOTOMETRIC DETERMINATION OF CHLORATE ION,
W71-03994 02K

MISSOURI UNIV., ROLLA. DEPT. OF GEOLOGY.
THE BACKGROUND CONCENTRATIONS OF COPPER, LEAD, AND ZINC IN STREAMS OF THE 'NEW LEAD BELT', MISSOURI,
W71-04182 05A

MISSOURI WATER RESOURCES RESEARCH CENTER, COLUMBIA.
THE EVALUATION OF ENVIRONMENTAL ALTERATION BY THERMAL LOADING AND ACID POLLUTION IN THE COOLING RESERVOIR OF A STEAM-ELECTRIC STATION,
W71-04019 05C

MONTANA STATE UNIV., BOZEMAN.
GROUNDWATER STORAGE CONTROL UNDER INSTITUTIONAL RESTRICTIONS,
W71-04024 04B

MUSKEGON COUNTY BOARD, MICH. DEPT. OF PUBLIC WORKS.
ENGINEERING FEASIBILITY DEMONSTRATION STUDY FOR MUSKEGON COUNTY, MICHIGAN, WASTE WATER TREATMENT-IRRIGATION SYSTEM.
W71-04186 05D

NATIONAL BUREAU OF STANDARDS, WASHINGTON, D.C. INST. FOR BASIC STANDARDS.
THEORETICAL MEAN ACTIVITY COEFFICIENTS OF STRONG ELECTROLYTES IN AQUEOUS SOLUTIONS FROM 0 TO 100 DEG C,
W71-04183 01B

NATIONAL OFFICE OF IRRIGATION, RABAT (MOROCCO).
DETERMINATION OF MAXIMUM FLOW AND FLOOD HYDROGRAPHS (FRENCH),
W71-03985 02E

NATIONAL WEATHER SERVICE, SILVER SPRING, MD. OFFICE OF HYDROLOGY.
WATER SUPPLY OUTLOOK FOR THE WESTERN UNITED STATES, 1970-71 WATER YEAR.
W71-03927 02B

NAVAL OCEANOGRAPHIC OFFICE, WASHINGTON, D.C. PROJECT GOPAR.
CHEMICAL EXCHANGE BETWEEN SEA WATER AND DEEP OCEAN BASALTS,
W71-03956 02K

NAVAL RESEARCH LAB., WASHINGTON, D.C.
SURFACE CHEMISTRY STUDIES ON THE BAY OF PANAMA,
W71-04001 02L

NAVAL WEAPONS CENTER, CHINA LAKE, CALIF. MICHELSON LABS.
AND BORON COMMUNITY SERVICES DISTRICT, CALIF.
ARSENIC IN POTABLE DESERT GROUNDWATER AN ANALYSIS PROBLEM,
W71-04109 02K

NEBRASKA UNIV., LINCOLN. DEPT. OF AGRONOMY.
PEDOGENIC DISTRIBUTION OF ZINC IN MOLLISOLS AND ASSOCIATED ENTISOLS IN NEBRASKA,
W71-03940 02G

NEBRASKA UNIV., LINCOLN. WATER RESOURCES RESEARCH INST.
UTILIZATION OF THE STORAGE POTENTIAL OF RIVER VALLEY AQUIFERS,
W71-03924 02F

NEW HAMPSHIRE UNIV., DURHAM. JACKSON ESTUARINE LAB.
THE PERIODIC CYCLE OF PARTICULATE MATTER IN A SHALLOW, TEMPERATE ESTUARY,
W71-03943 02L

NEW MEXICO BUREAU OF MINES AND MINERAL RESOURCES.
WASTE PROBLEMS RELATIVE TO MINING AND MILLING OF MOLYBDENUM,
W71-03888 05D

NEW MEXICO STATE UNIV., UNIVERSITY PARK. ENGINEERING EXPERIMENT STATION.
OPTIMIZATION FOR PLANNING AND LOCATION OF PRECIPITATION STATIONS IN THE JEMEZ MOUNTAINS,
W71-04033 06A

NEW YORK STATE COLL. OF AGRICULTURE, ITHACA. DEPT. OF CONSERVATION.
ASPECTS OF PLANNING, EVALUATION, AND DECISION-MAKING IN SPORT FISHERY MANAGEMENT.
W71-04271 06B

THE ROLE OF ECONOMIC EVALUATION IN GOVERNMENTAL ANALYSIS,
W71-04272 06B

EVALUATION OF INTANGIBLES,
W71-04273 06B

AN ECOLOGICAL CRITERION FOR EVALUATING AN ENVIRONMENT,
W71-04274 06B

POLLUTION PROBLEMS, RESOURCE POLICY AND THE SCIENTIST,
W71-04280 06B

NEW YORK STATE DIV. OF WATER RESOURCES, ALBANY.
PLANNING FOR THE OSWEGO BASIN IN NEW YORK--A SYSTEMS APPROACH,
W71-03860 06A

NEW ZEALAND FOREST SERVICE, WELLINGTON. PROTECTION FORESTRY BRANCH.
MEASURING STREAM DISCHARGE USING THE DYE-DILUTION METHOD (CHEMICAL GAUGING),
W71-03930 07B

NORTH AMERICAN WEATHER CONSULTANTS, PASADENA, CALIF.
CLOUD SEEDING POTENTIALITIES IN LOS ANGELES COUNTY.
W71-03903 03B

NORTH CAROLINA UNIV., CHAPEL HILL.
SUPERPOSITION OF SUBMONTHLY FLOWS IN STOCHASTIC HYDROLOGY,
W71-04040 02E

NORTH CAROLINA UNIV., CHAPEL HILL. DEPT. OF CITY AND REGIONAL PLANNING.
WATER RESOURCES PLANNING IN THE URBAN-METROPOLITAN CONTEXT,
W71-03861 06B

NORTH CAROLINA UNIV., CHAPEL HILL. INST. FOR RESEARCH IN SOCIAL SCIENCE.
1969 RESERVOIR LAND USE SURVEYS FIELD REPORT AND PROCEDURAL MANUAL,
W71-04039 04A

NORTH CAROLINA WATER RESOURCES RESEARCH INST., RALEIGH.
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W71-03921 09A

NORTH DAKOTA STATE UNIV., FARGO. DEPT. OF AGRICULTURAL ECONOMICS.
IRRIGATION AS A FARM GROWTH STRATEGY,
W71-04290 03F

NORTH DAKOTA STATE UNIV., FARGO. DEPT. OF SOILS.
INFLUENCE OF MANAGEMENT AND ENVIRONMENTAL FACTORS ON EXTENT OF SOIL WATER DEPLETION BY SPRING WHEAT,
W71-04303 03F

NORTHWESTERN UNIV., EVANSTON, ILL.
COMPARISON OF THE DESCRIPTORS OF SEDIMENT GRAIN-SIZE DISTRIBUTIONS,
W71-03947 02J

NORTHWESTERN UNIV., EVANSTON, ILL. DEPT. OF CIVIL ENGINEERING.
LITERATURE SURVEY OF MOISTURE MIGRATION IN SOILS DUE TO THERMAL GRADIENTS,
W71-04000 02C

OAK RIDGE NATIONAL LAB., TENN.
ABSTRACTS OF LITERATURE ON THE DISTILLATION OF SEAWATER AND ON THE USE OF NUCLEAR ENERGY FOR DESALTING.
W71-04226 03A

DRY LANDS AND A HUNGRY WORLD,
W71-04291 06B

OFFICE OF SALINE WATER, WASHINGTON, D.C.
INDUSTRIAL WASTE DESALTING FOR BYPRODUCT RECOVERY,
W71-04286 05D

OHIO DEPT. OF NATURAL RESOURCES, COLUMBUS. DIV. OF WATER.
PRINCIPLES OF WATER RIGHTS LAW IN OHIO,
W71-04022 06E

OHIO STATE UNIV., COLUMBUS. DEPT. OF CIVIL ENGINEERING.
RESPIRATORY RELATIONSHIPS OF A SYMBIOTIC ALGAL-BACTERIAL CULTURE FOR WASTE WATER NUTRIENT REMOVAL,
W71-04079 05D

OHIO STATE UNIV., COLUMBUS. DEPT. OF ECONOMICS.
PRIVATE AND SOCIAL COSTING AND PRICING AS DECISION DETERMINANTS,
W71-03863 06C

OKLAHOMA STATE UNIV., STILLWATER. DEPT. OF AGRICULTURAL ECONOMICS.
ALTERNATIVE CROP ENTERPRISE BUDGETS FOR IRRIGATED PRODUCTION, SOUTHWESTERN OKLAHOMA,
W71-04294 03F

OKLAHOMA STATE UNIV., STILLWATER. SCHOOL OF CIVIL ENGINEERING.
METABOLIC RESPONSE OF ACTIVATED SLUDGE TO SODIUM PENTACHLOROPHENOL,
W71-04088 05D

OLD DOMINION UNIV., NORFOLK, VA. INST. OF OCEANOGRAPHY.
SAND WAVES AND TIDAL CHANNELS IN THE ENTRANCE TO CHESAPEAKE BAY,
W71-03958 02L

OTAGO UNIV., DUNEDIN (NEW ZEALAND). DEPT. OF GEOGRAPHY.
A CONTRIBUTION TO THE PROBLEM OF SPACING RAINGAUGES IN RUGGED TERRAIN,
W71-04122 07A

PAKISTAN METEOROLOGICAL DEPT., KARACHI. CENTRAL SECRETARIAT.
HEAVY RAINFALL IN PAKISTAN AND ITS ASSOCIATED FLOOD,
W71-04168 02B

PAN AMERICAN PETROLEUM CORP., TULSA, OKLA. RESEARCH CENTER.
USE OF PORE CASTS AND SCANNING ELECTRON MICROSCOPE TO STUDY PORE GEOMETRY,
W71-03946 07B

PENNSYLVANIA DEPT. OF MINES AND MINERAL INDUSTRIES, HARRISBURG.
MINE WASTE WATER PROBLEMS IN EUROPE,
W71-03898 05D

PENNSYLVANIA STATE UNIV., UNIVERSITY PARK. DEPT. OF CIVIL ENGINEERING.
CHEMICAL PRECIPITATION OF PHOSPHATE WITHIN A HIGH RATE BIO OXIDATION SYSTEM I. SYNTHETIC SEWAGE STUDIES,
W71-03900 05D

BEDLOAD FORMULAS. PART A. A SELECTION OF BEDLOAD FORMULAS. PART B. PROGRAM LISTINGS FOR BEDLOAD FORMULAS,
W71-03999 02E

PORTLAND STATE UNIV., OREGON.
SUPERFARMS VS. SAGEBRUSH NEW IRRIGATION DEVELOPMENTS ON THE SNAKE RIVER PLAIN,
W71-04056 03F

POWELL (SHEPPARD T.) AND ASSOCIATES, BALTIMORE, MD.
ENGINEERING EVALUATION OF FACTORS AFFECTING QUALITY OF WATER SOURCES AVAILABLE FOR SALINE WATER CONVERSION PLANTS,
W71-03916 03A

PUBLIC ADMINISTRATION SERVICE, CHICAGO, ILL.
PUBLIC WATER POLICY IN TENNESSEE.
W71-04308 06E

PUBLIC WORKS RESEARCH INST., TOKYO (JAPAN).
ANALYSIS OF SNOW MELT FLOODS,
W71-04179 02E

PURDUE UNIV., LAFAYETTE, IND. SCHOOL OF CIVIL ENGINEERING.
RESOURCE SYSTEMS MODELS IN DECISION MAKING,
W71-03856 06A

PURDUE UNIV., LAFAYETTE, IND. WATER RESOURCES RESEARCH CENTER.
NATURAL RESOURCE SYSTEMS MODELS IN DECISION MAKING.
W71-03855 06A

QUEEN MARY COLL., LONDON (ENGLAND).
VARIATION IN THE LEVEL OF THE CLIFF/SHORE PLATFORM JUNCTION ALONG THE SOUTH COAST OF GREAT BRITAIN,
W71-03952 02J

RAND CORP., SANTA MONICA, CALIF.
A WATER-QUALITY SIMULATION MODEL FOR WELL-MIXED ESTUARIES AND COASTAL SEAS VOLUME I, PRINCIPLES OF COMPUTATION,
W71-04038 06A

REGIONAL INST. OF TECH., JAMSHEDPUR (INDIA). DEPT. OF APPLIED MECHANICS.
SIMILITUDE CONCEPT IN PARTIALLY SATURATED SOILS,
W71-04131 02G

REGIONAL METEOROLOGICAL CENTER, LAHORE (PAKISTAN).
HEAVY RAINFALL AND ASSOCIATED FLOODS IN WEST PAKISTAN,
W71-04169 02B

RESEARCH INST. FOR WATER RESOURCES DEVELOPMENT, BUDAPEST (HUNGARY) AND TRANSDANUBIAN WATER AUTHORITY, SZEKESFEHERVAR (HUNGARY). WATER MANAGEMENT.
CONSTRUCTION OF THE UNIT HYDROGRAPH BY THE METHOD OF HYDROLOGIC ANALOGY (FRENCH),
W71-03981 02E

RESEARCH INST. FOR WATER RESOURCES DEVELOPMENT, BUDAPEST (HUNGARY).
SOME PROBLEMS OF DETERMINING THE WATER EQUIVALENT OF THE SNOW COVER,
W71-04173 02C

RESEARCH INST. OF AMELIORATION, PRAGUE (CZECHOSLOVAKIA).
RUNOFF CONDITIONS DURING SNOW THAWING IN THE MORAVIAN-SILESIAN BESKIDS,
W71-04175 02C

RESOURCES FOR THE FUTURE, INC, WASHINGTON, D.C.
NEW HORIZONS IN WATER RESOURCES ADMINISTRATION,
W71-03887 06E

RESOURCES FOR THE FUTURE, INC., WASHINGTON, D.C.
A QUANTITATIVE FRAMEWORK FOR RESIDUALS--ENVIRONMENTAL QUALITY MANAGEMENT,
W71-03858 05G

REX CHAINBELT INC., MILWAUKEE, WIS.
DESIGN OF PLUGFLOW POST AERATION BASIN,
W71-03889 05D

ROBERT A. TAFT SANITARY ENGINEERING CENTER, CINCINNATI, OHIO. CINCINNATI WATER RESEARCH LAB.
BIODEGRADABILITY OF POTENTIAL ORGANIC SUBSTITUTES FOR PHOSPHATES,
W71-04072 05D

ROBERT A. TAFT SANITARY ENGINEERING CENTER, CINCINNATI, OHIO. WATER POLLUTION SURVEILLANCE SYSTEM.
A DIRECT-READING SPECTROCHEMICAL PROCEDURE FOR THE MEASUREMENT OF NINETEEN MINOR ELEMENTS IN NATURAL WATER,
W71-04211 05A

ROBERT A. TAFT WATER RESEARCH CENTER, CINCINNATI, OHIO.
NEUTRALIZATION OF HIGH FERRIC IRON ACID MINE DRAINAGE,
W71-04189 05D

ROSENSTIEL SCHOOL OF MARINE AND ATMOSPHERIC SCIENCES, MIAMI, FLA.
SUBMARINE VOLCANISM AS A SOURCE FOR IRON,
W71-03955 02K

ROYAL OBSERVATORY, HONG KONG. DIV. OF RESEARCH AND CLIMATOLOGY.
DETECTION OF PRECIPITATION BY RADAR,
W71-04154 07B

ANALYSIS OF RAINFALL OVER A SMALL AREA,
W71-04155 02B

RAIN FROM TROPICAL CYCLONES AND TROUGH-TYPE SYSTEMS,
W71-04156 02B

ANALYSIS OF MESOSCALE SYSTEMS,
W71-04157 02B

SURVEY OF OBJECTIVE METHODS USED IN HONG KONG FOR PREDICTING TYPHOON MOVEMENT,
W71-04158 02B

RUTGERS-THE STATE UNIV., NEW BRUNSWICK, N.J. WATER RESOURCES RESEARCH INST.
PRIVATE AND SOCIAL COSTING AS DECISION DETERMINANTS IN WATER RESOURCES,
W71-03864 06B

SANTEE COUNTY WATER DISTRICT, CALIF.
SANTEE PROJECT CONTINUES TO SHOW THE WAY,
W71-03904 05D

SCOTT POLAR RESEARCH INST., CAMBRIDGE (ENGLAND).
RECONSTRUCTION OF SUBGLACIAL RELIEF FROM RADIO ECHO SOUNDING RECORDS,
W71-04112 02C

SINGAPORE METEOROLOGICAL SERVICE.
THE CIRCULATION PATTERN OVER SINGAPORE AND THE EAST COAST OF WEST MALAYSIA DURING JANUARY AND FEBRUARY 1967 COMPARED WITH THAT OF JANUARY AND FEBRUARY 1968,
W71-04170 02B

SMITHSONIAN INSTITUTION, WASHINGTON, D.C.
MICROBIAL CARBONATE AND PHOSPHATE PRECIPITATES FROM SEA WATER CULTURES,
W71-03950 02K

SOUTH DAKOTA STATE UNIV., BROOKINGS. DEPT. OF AGRICULTURAL ENGINEERING.
INFLUENCE OF LOW RATES OF WATER APPLICATION BY SPRINKLERS ON THE MICROCLIMATE,
W71-03925 02D

SOUTHERN CALIFORNIA METROPOLITAN WATER DISTRICT, SAN DIEGO.
BOLSA ISLAND NUCLEAR POWER AND DESALTING PROJECT FACILITIES (COST AND DESCRIPTION) AND COST OF DESALTED WATER,
W71-03915 03A

SOUTHERN CONNECTICUT STATE COLL., NEW HAVEN. DEPT. OF GEOGRAPHY.
FEEDING A DESERT CITY ANTOFAGASTA, CHILE,
W71-04055 03F

STANFORD UNIV., CALIF. DEPT. OF CIVIL ENGINEERING.
THE ANAEROBIC FILTER FOR WASTE TREATMENT,
W71-04075 05D

STATE HYDROLOGICAL INST., LENINGRAD (USSR).
SNOWMELT AND WATER YIELD FROM SNOW COVER,
W71-04171 02C

A METHOD FOR THE COMPUTATION OF WATER YIELD FROM SNOW DURING SNOWMELT PERIOD,
W71-04172 02C

METHODS OF SNOWMELT MAXIMUM DISCHARGE COMPUTATION IN CASES OF ABSENCE OR INSUFFICIENCY OF HYDROMETRIC DATA,
W71-04177 02C

STOCKHOLM INTERNATIONAL PEACE RESEARCH INST. (SWEDEN).
TOWARDS A BETTER USE OF THE OCEAN CONTEMPORARY LEGAL PROBLEMS IN OCEAN DEVELOPMENT,
W71-04338 06E

STOCKHOLM UNIV. (SWEDEN). ASKO LAB.
A CHAMBER FOR OFFERING ALTERNATIVE CONDITIONS TO SMALL MOTILE AQUATIC ANIMALS,
W71-03853 05C

SYRACUSE UNIV., N.Y. BIOENVIRONMENTAL ENGINEERING DIV.
SOLIDS SEPARATION BY ULTRAFILTRATION FOR CONCENTRATED ACTIVATED SLUDGE,
W71-04087 05D

SYRACUSE UNIV., N.Y. DEPT. OF CIVIL ENGINEERING.
PROTOTYPE STUDIES OF COMBINED TREATMENT OF WASTES FROM 22 TANNERIES AND TWO MUNICIPALITIES,
W71-03892 05D

TECHNICOMP, INC., GREAT NECK, N.Y.
COMPUTER DESIGN OF SEWAGE TREATMENT PLANTS,
W71-03893 05D

TECHNION--ISRAEL INST. OF TECH., HAIFA.
SATURATION-UNSATURATION TRANSITION IN INFILTRATION TO A NON-UNIFORM SOIL PROFILE,
W71-04066 02G

TECK TOWNSHIP (ONTARIO).
BIOLOGICAL CHEMICAL COMBINATION DRAMATICALLY CUTS TREATMENT,
W71-04086 05D

TEMPLE UNIV., PHILADELPHIA, PA. DEPT. OF ECONOMICS.
THE EVALUATION OF THE COST OF ALTERNATIVE STRATEGIES FOR AIR POLLUTION CONTROL,
W71-03859 06A

TENNESSEE DEPT. OF CONSERVATION, NASHVILLE. WATER RESOURCES AND GEOLOGICAL SURVEY, NASHVILLE, TENN.
WATER USE IN TENNESSEE, PART D - SUMMARY,
W71-04324 06D

TENNESSEE UNIV., KNOXVILLE. SCHOOL OF ENGINEERING.
ESTABLISHING AN ENGINEERING BASIS FOR FLOOD PLAIN REGULATIONS,
W71-04270 04A

TEXAS INSTRUMENTS INC., DALLAS. SERVICES GROUP.
UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME VI. TEST REQUIREMENTS FOR OCEANOGRAPHIC AND METEOROLOGICAL SENSORS,
W71-04014 07B

TEXAS INSTRUMENTS, INC., DALLAS. SERVICES GROUP.
UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME I. STATE-OF-THE-ART OF OCEANOGRAPHIC AND METEOROLOGICAL SENSORS, TUTORIAL DISCUSSION,
W71-04009 07B

UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME II. STATE-OF-THE-ART OF OCEANOGRAPHIC AND METEOROLOGICAL SENSORS, CATALOG,
W71-04010 07B

UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME III. THE SURVIVAL ENVIRONMENT FOR OCEANOGRAPHIC AND METEOROLOGICAL SENSORS,
W71-04011 07B

UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME IV. THE FORMATTING AND TRANSMISSION OF DATA FROM OCEANOGRAPHIC SENSORS,
W71-04012 07B

UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. VOLUME V. ANALYSIS OF APPLYING STANDARDIZATION TECHNIQUES TO OCEANOGRAPHIC SENSORS,
W71-04013 07B

TEXAS UNIV., AUSTIN. CENTER FOR RESEARCH IN WATER RESOURCES.
ENGINEERING ASPECTS OF SURFACE AERATION DESIGN,
W71-04073 05D

TEXAS UNIV., AUSTIN. ENVIRONMENTAL HEALTH ENGINEERING. RESEARCH LAB.
THE EFFECT OF SHORT-TERM TEMPERATURE VARIATIONS ON METHANE PRODUCTION,
W71-04077 05D

TOKYO METROPOLITAN UNIV. (JAPAN). FACULTY OF SCIENCE.
SECULAR VARIATION OF ARIDITY IN THE WORLD,
W71-04288 02A

TRANSDANUBIAN WATER AUTHORITY, SZEKESEHERVAR (HUNGARY). WATER MANAGEMENT.
ANALYSIS OF THE RELATION BETWEEN PRECIPITATION AND FLOOD FLOW WITH THE AID OF A TRIPLE TRANSFORMATION BASED ON THE UNIT HYDROGRAPH METHOD (FRENCH),
W71-03980 02A

TRANSDANUBIAN WATER AUTHORITY, SZEKESFEHERVAR (HUNGARY). WATER MANAGEMENT.
ANALYSIS OF FLOOD DURATION (FRENCH),
W71-03984 02E

TYCO LABS., INC., WALTHAM, MASS.
THE USE OF AMALGAM ELECTRODES TO MEASURE ACTIVITY COEFFICIENTS IN MULTICOMPONENT SALT SOLUTIONS,
W71-04221 01B

UKRAINSKII NAUCHNO-ISSLEDOVATELSKII GIDROMETEOROLOGICHESKII INSTITUT, KIEV (USSR).
CALCULATION OF THE MAXIMUM RUNOFF IN FLOODS FROM RAINFALL OVER THE TERRITORIES OF THE UKRAINE AND MOLDAVIA (WITH NO OR INSUFFICIENT HYDROMETRICAL DATA),
W71-03991 02A

A METHOD FOR THE CALCULATION OF SPRING FLOODS,
W71-04178 02E

UNIVERSAL DESALTING CORP, NEW YORK.
SECOND REPORT ON HORIZONTAL-TUBE MULTIPLE-EFFECT PROCESS PILOT PLANT TESTS AND DESIGN,
W71-04220 03A

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG (SOUTH AFRICA). DEPT. OF GEOGRAPHY.
SOME PROBLEMS OF A KARST AREA IN THE EASTERN TRANSVAAL, SOUTH AFRICA,
W71-04053 02G

UTAH WATER RESEARCH LAB., LOGAN.
HYDROGRAPH SYNTHESIS FOR WATERSHED SUBZONES FROM MEASURED URBAN PARAMETERS,
W71-04184 04C

VIRGINIA STATE COLL., PETERSBURG. DEPT. OF BIOLOGY.
A WINTER LIMNOLOGICAL STUDY OF LAKE WILCOX A FRESHWATER IMPOUNDMENT,
W71-03957 02H

VIRGINIA STATE WATER CONTROL BOARD, RICHMOND.
STATE WATER CONTROL LAW.
W71-04335 06E

VSESOYUZNYI NAUCHNO-ISSLEDOVATELSKII INSTITUT VODOSNABZHENIYA, KANALIZATSII, GIDROTEKHNICHESKIKH SOORUZHENII I INZHENERNOI GIDROGEOLOGII, MOSCOW (USSR) AND KHABAROVSK INST. OF RAILWAY ENGINEERS (USSR).
FORMATION OF RAINFALL FLOODS ON SMALL WATERSHEDS. PRINCIPLES OF MAXIMUM STORM RUNOFF COMPUTATION,
W71-03988 02A

VYZKUMNY USTAV RYBARSKY A HYDROBIOLOGICKY VODNANY, PRAGUE (CZECHOSLOVAKIA).
THE EFFECT OF SOME SOLVENTS ON LOWER WATER ANIMALS AND ON FISHES,
W71-03854 05C

WATER POLLUTION RESEARCH LAB., STEVENAGE (ENGLAND).
MATHEMATICAL MODELS AS AN AID IN THE SOLUTION OF WATER POLLUTION CONTROL PROBLEMS,
W71-03884 05G

WATER RESOURCES ENGINEERS, INC, WALNUT CREEK, CALIF.
AN APPROACH TO FINDING RESERVOIR RULES FOR POWER OPTIMIZATION,
W71-04037 04A

WATERLOOPKUNDIG LABORATORIUM, DELFT (NETHERLANDS).
ON THE ACCURACY OF BED-MATERIAL SAMPLING,
W71-04132 02J

WEIZMANN INST. OF SCIENCE, REHOVOTH (ISRAEL).
ENVIRONMENTAL ISOTOPE BALANCE OF LAKE TIBERIAS,
W71-04140 02A

WEIZMANN INST. OF SCIENCE, REHOVOTH(ISRAEL).
WATER TRANSPORT THROUGH PLASTICIZED MEMBRANES,
W71-03912 03A

WEST VIRGINIA CENTER FOR APPALACHIAN STUDIES AND DEVELOPMENT, MORGANTOWN.
WATER RIGHTS LAW AND MANAGEMENT IN WEST VIRGINIA -- FUTURE NEEDS AND ALTERNATIVES,
W71-03880 06E

WEST VIRGINIA UNIV., MORGANTOWN. DEPT. OF CIVIL ENGINEERING AND NEW YORK STATE DEPT. OF CONSERVATION, SYRACUSE. DIV. OF WATER RESOURCES.
MINE ACID DRAINAGE AND ASSOCIATED FLOW FLUCTUATIONS,
W71-03938 05B

WESTON (ROY F.), INC., WEST CHESTER, PA.
SYSTEM OPTIMIZATION FOR RIVER BASIN WATER QUALITY MANAGEMENT,
W71-03881 05G

WISCONSIN UNIV., MADISON. DEPT. OF REGIONAL PLANNING.
INSTITUTIONAL DESIGN FOR WATER QUALITY MANAGEMENT THE IMPLICATIONS OF A SYSTEMS APPROACH FOR LEGAL AND ADMINISTRATIVE ARRANGEMENTS,
W71-03867 06E

WISCONSIN UNIV., MADISON. GEOLOGICAL AND NATURAL HISTORY SURVEY.
MINERALOGY OF SOME ARID AND SEMIARID LAND SOILS OF IRAQ,
W71-04061 02G

WOODS HOLE OCEANOGRAPHIC INSTITUTION, MASS.
THE DIFFUSION OF IONS IN UNCONSOLIDATED SEDIMENTS,
W71-03954 02K

WYOMING GAME AND FISH RESEARCH LAB., LARAMIE.
STUDY OF WATER POLLUTION PROBLEMS WHICH AFFECT FISH AND OTHER AQUATIC FORMS,
W71-03852 05C

ZAKAVKAZSKII NAUCHNO-ISSLEDOVATELSKII GIDROMETEOROLOGICHESKII INSTITUT, TIFLIS (USSR).
METHOD OF ESTIMATING STORM RUNOFF FROM SMALL DRAINAGE BASINS,
W71-03992 02E

ACCESSION NUMBER INDEX

05C	W71-03851	02F	W71-03924	08F	W71-03997	05D	W71-04070
05C	W71-03852	02D	W71-03925	08C	W71-03998	06E	W71-04071
05C	W71-03853	01B	W71-03926	02E	W71-03999	05D	W71-04072
05C	W71-03854	02B	W71-03927	02C	W71-04000	05D	W71-04073
06A	W71-03855	05A	W71-03928	02L	W71-04001	06E	W71-04074
06A	W71-03856	05A	W71-03929	04A	W71-04002	05D	W71-04075
06A	W71-03857	07B	W71-03930	08A	W71-04003	05D	W71-04076
05G	W71-03858	02A	W71-03931	08F	W71-04004	05D	W71-04077
06A	W71-03859	02E	W71-03932	03B	W71-04005	06E	W71-04078
06A	W71-03860	07A	W71-03933	02G	W71-04006	05D	W71-04079
06B	W71-03861	02F	W71-03934	08B	W71-04007	05D	W71-04080
06B	W71-03862	02F	W71-03935	08A	W71-04008	06E	W71-04081
06C	W71-03863	07C	W71-03936	07B	W71-04009	05D	W71-04082
06B	W71-03864	02F	W71-03937	07B	W71-04010	05D	W71-04083
06E	W71-03865	05B	W71-03938	07B	W71-04011	05D	W71-04084
06E	W71-03866	02G	W71-03939	07B	W71-04012	05D	W71-04085
06E	W71-03867	02G	W71-03940	07B	W71-04013	05D	W71-04086
06B	W71-03868	02G	W71-03941	07B	W71-04014	05D	W71-04087
02A	W71-03869	02G	W71-03942	08F	W71-04015	05D	W71-04088
02F	W71-03870	02L	W71-03943	08D	W71-04016	06E	W71-04089
02E	W71-03871	02J	W71-03944	08C	W71-04017	06E	W71-04090
05B	W71-03872	02K	W71-03945	06E	W71-04018	06E	W71-04091
05B	W71-03873	07B	W71-03946	05C	W71-04019	06E	W71-04092
05B	W71-03874	02J	W71-03947	02B	W71-04020	06E	W71-04093
05B	W71-03875	02J	W71-03948	06E	W71-04021	06E	W71-04094
05B	W71-03876	07B	W71-03949	06E	W71-04022	06E	W71-04095
05B	W71-03877	02K	W71-03950	06C	W71-04023	06E	W71-04096
06E	W71-03878	02J	W71-03951	04B	W71-04024	06E	W71-04097
05G	W71-03879	02J	W71-03952	05G	W71-04025	06E	W71-04098
06E	W71-03880	02J	W71-03953	06A	W71-04026	06E	W71-04099
05G	W71-03881	02K	W71-03954	06A	W71-04027	06E	W71-04100
06E	W71-03882	02K	W71-03955	03B	W71-04028	06E	W71-04101
06E	W71-03883	02K	W71-03956	06B	W71-04029	06E	W71-04102
05G	W71-03884	02H	W71-03957	04A	W71-04030	09D	W71-04103
06A	W71-03885	02L	W71-03958	06E	W71-04031	06E	W71-04104
05D	W71-03886	07B	W71-03959	06G	W71-04032	06E	W71-04105
06E	W71-03887	02E	W71-03960	06A	W71-04033	06E	W71-04106
05D	W71-03888	02E	W71-03961	04A	W71-04034	05D	W71-04107
05D	W71-03889	02J	W71-03962	06B	W71-04035	01B	W71-04108
05D	W71-03890	02J	W71-03963	05G	W71-04036	02K	W71-04109
05D	W71-03891	02G	W71-03964	04A	W71-04037	07B	W71-04110
05D	W71-03892	02J	W71-03965	06A	W71-04038	04A	W71-04111
05D	W71-03893	07B	W71-03966	04A	W71-04039	02C	W71-04112
05D	W71-03894	07B	W71-03967	02E	W71-04040	10	W71-04113
05G	W71-03895	02E	W71-03968	06A	W71-04041	05C	W71-04114
05D	W71-03896	02J	W71-03969	04B	W71-04042	05A	W71-04115
05D	W71-03897	02J	W71-03970	06A	W71-04043	05C	W71-04116
05D	W71-03898	02C	W71-03971	04A	W71-04044	02B	W71-04117
05D	W71-03899	02C	W71-03972	05F	W71-04045	02A	W71-04118
05D	W71-03900	02E	W71-03973	04A	W71-04046	05A	W71-04119
05D	W71-03901	02K	W71-03974	06A	W71-04047	05A	W71-04120
05D	W71-03902	02E	W71-03975	02K	W71-04048	05B	W71-04121
03B	W71-03903	02E	W71-03976	03C	W71-04049	07A	W71-04122
05D	W71-03904	02E	W71-03977	02G	W71-04050	07B	W71-04123
08A	W71-03905	02E	W71-03978	03F	W71-04051	02E	W71-04124
08A	W71-03906	02E	W71-03979	03F	W71-04052	02F	W71-04125
05B	W71-03907	02A	W71-03980	02G	W71-04053	02F	W71-04126
02H	W71-03908	02E	W71-03981	03F	W71-04054	07B	W71-04127
06B	W71-03909	02A	W71-03982	03F	W71-04055	08B	W71-04128
06B	W71-03910	02A	W71-03983	03F	W71-04056	08B	W71-04129
03A	W71-03911	02E	W71-03984	02F	W71-04057	02F	W71-04130
03A	W71-03912	02E	W71-03985	03F	W71-04058	02G	W71-04131
03A	W71-03913	02E	W71-03986	03F	W71-04059	02J	W71-04132
05D	W71-03914	02E	W71-03987	03F	W71-04060	02A	W71-04133
03A	W71-03915	02A	W71-03988	02G	W71-04061	02A	W71-04134
03A	W71-03916	02E	W71-03989	02D	W71-04062	02A	W71-04135
05C	W71-03917	02E	W71-03990	02D	W71-04063	02A	W71-04136
05C	W71-03918	02A	W71-03991	03F	W71-04064	02A	W71-04137
04B	W71-03919	02E	W71-03992	03F	W71-04065	02A	W71-04138
05C	W71-03920	02B	W71-03993	02G	W71-04066	02A	W71-04139
09A	W71-03921	02K	W71-03994	05B	W71-04067	02A	W71-04140
05C	W71-03922	02J	W71-03995	02G	W71-04068	02A	W71-04141
02H	W71-03923	08C	W71-03996	04C	W71-04069	02A	W71-04142

04A	W71-04143	05A	W71-04195	04A	W71-04247	02I	W71-04299
04A	W71-04144	07B	W71-04196	03B	W71-04248	02I	W71-04300
04A	W71-04145	06E	W71-04197	02C	W71-04249	02I	W71-04301
06E	W71-04146	06E	W71-04198	04D	W71-04250	03F	W71-04302
04D	W71-04147	05A	W71-04199	07B	W71-04251	03F	W71-04303
04D	W71-04148	05A	W71-04200	06E	W71-04252	03F	W71-04304
04D	W71-04149	05A	W71-04201	03B	W71-04253	06E	W71-04305
07C	W71-04150	05A	W71-04202	06E	W71-04254	06C	W71-04306
07C	W71-04151	06E	W71-04203	06E	W71-04255	06E	W71-04307
02B	W71-04152	05A	W71-04204	05G	W71-04256	06E	W71-04308
02B	W71-04153	05A	W71-04205	04A	W71-04257	09D	W71-04309
07B	W71-04154	05A	W71-04206	02C	W71-04258	06E	W71-04310
02B	W71-04155	05A	W71-04207	07B	W71-04259	06E	W71-04311
02B	W71-04156	05C	W71-04208	02J	W71-04260	06E	W71-04312
02B	W71-04157	05A	W71-04209	02J	W71-04261	06E	W71-04313
02B	W71-04158	07C	W71-04210	04A	W71-04262	06E	W71-04314
02E	W71-04159	05A	W71-04211	04A	W71-04263	06E	W71-04315
02B	W71-04160	05C	W71-04212	07C	W71-04264	06E	W71-04316
02B	W71-04161	05A	W71-04213	03F	W71-04265	06E	W71-04317
02B	W71-04162	05A	W71-04214	06E	W71-04266	06E	W71-04318
02B	W71-04163	05C	W71-04215	06D	W71-04267	06E	W71-04319
02B	W71-04164	05B	W71-04216	06E	W71-04268	06E	W71-04320
02E	W71-04165	06E	W71-04217	05D	W71-04269	06E	W71-04321
02B	W71-04166	05A	W71-04218	04A	W71-04270	06E	W71-04322
02B	W71-04167	07B	W71-04219	06B	W71-04271	06E	W71-04323
02B	W71-04168	03A	W71-04220	06B	W71-04272	06D	W71-04324
02B	W71-04169	01B	W71-04221	06B	W71-04273	06E	W71-04325
02B	W71-04170	03A	W71-04222	06B	W71-04274	06E	W71-04326
02C	W71-04171	02K	W71-04223	06C	W71-04275	06E	W71-04327
02C	W71-04172	03A	W71-04224	06E	W71-04276	06E	W71-04328
02C	W71-04173	03A	W71-04225	06E	W71-04277	06E	W71-04329
02C	W71-04174	03A	W71-04226	06E	W71-04278	06E	W71-04330
02C	W71-04175	02B	W71-04227	06E	W71-04279	06E	W71-04331
02E	W71-04176	04A	W71-04228	06B	W71-04280	06E	W71-04332
02C	W71-04177	03A	W71-04229	06E	W71-04281	06E	W71-04333
02E	W71-04178	04D	W71-04230	06E	W71-04282	06E	W71-04334
02E	W71-04179	03F	W71-04231	06B	W71-04283	06E	W71-04335
02C	W71-04180	03F	W71-04232	06C	W71-04284	06E	W71-04336
02A	W71-04181	04A	W71-04233	06B	W71-04285	06E	W71-04337
05A	W71-04182	06B	W71-04234	05D	W71-04286	06E	W71-04338
01B	W71-04183	02B	W71-04235	03D	W71-04287	06E	W71-04339
04C	W71-04184	02D	W71-04236	02A	W71-04288	06E	W71-04340
05D	W71-04185	02I	W71-04237	03F	W71-04289	06E	W71-04341
05D	W71-04186	02I	W71-04238	03F	W71-04290	06E	W71-04342
05G	W71-04187	02I	W71-04239	06B	W71-04291	06E	W71-04343
05D	W71-04188	03B	W71-04240	04B	W71-04292	06E	W71-04344
05D	W71-04189	02I	W71-04241	07C	W71-04293	06E	W71-04345
07B	W71-04190	02D	W71-04242	03F	W71-04294	06E	W71-04346
05A	W71-04191	06E	W71-04243	02I	W71-04295	06E	W71-04347
07B	W71-04192	06A	W71-04244	06E	W71-04296	06E	W71-04348
05C	W71-04193	06E	W71-04245	03F	W71-04297	06E	W71-04349
05B	W71-04194	06E	W71-04246	02B	W71-04298	06E	W71-04350

ABSTRACT SOURCES

Source	Accession Number	Total
A. Center of Competence		
U. S. Geological Survey - Hydrology	W71-03869--03877 03925--03995 04108--04145 04147--04183 04048	156
University of Arizona - Arid Lands Water Resources	W71-04050--04069 04227--04236 04288--04304	47
Cornell University - Policy Models for Water Resources Systems	W71-03884--03885 04023--04030 03857--03860 04032--04047 -03879, 03881	32
University of Texas - Wastewater Treatment and Management	W71-03886 03888--03900 04072--04073 04075--04077 04079--04080 04082--04088 04070, 04107	20
Rutgers--the State University - Water Resources Economics	W71-04265 04267--04275 04280--04287	18
Battelle Memorial Institute - Methods for Chemical and Biological Identification of Pollutants	W71-04190--04196 04199--04202 04204--04216 04218--04219	26
University of Washington - Water Quality Requirements for Aquatic Organisms	W71-03851--03854	4
University of Chicago - Metropolitan Water Resources Management	W71-03861--03863 03856	4
University of Florida - Eastern U. S. Water Law	W71-04089--04106 04305--04350 03878, 03887 03882, 03883 03880, 04018 04021, 04022 04031, 04071 04074, 04078 04081, 04146 04197, 04198 04203, 04217 04243, 04245 04246, 04252 04254--04257 04276--04279 04266	126

ABSTRACT SOURCES

Source	Accession Number	Total
B. State Water Resources Research Institutes		
Indiana Water Resources Research Center	W71-03855	1
Massachusetts Water Resources Research Center	W71-03918--03919	2
Arkansas Water Resources Research Center	W71-03920	1
North Carolina Water Resources Research Institute	W71-03921	1
Maine Water Resources Center	W71-03922	1
New York Water Resources and Marine Sciences Center	W71-03923	1
Nebraska Water Resources Research Institute	W71-03924	1
Missouri Water Resources Research Center	W71-04018	1
Florida Water Resources Research Center	W71-04020	1
Colorado Environmental Resources Center	W71-04049	1
Utah Center for Water Resources Research	W71-04184	1
C. Others		
Forest Service	W71-04237--04242 04247--04251 04258--04264 04244, 04253	20
Office of Saline Water	W71-03911--03916 04220--04226	13
Environmental Protection Agency - Water Quality Office	W71-04185--04189	5
Engineering Aspects of Urban Water Resources (H. G. Poertner)	W71-03901--03910	10
Office of Water Resources Research	W71-03917	1

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CENTERS OF COMPETENCE AND THEIR SUBJECT COVERAGE

- Ground and surface water hydrology at the Water Resources Division of the U.S. Geological Survey, U.S. Department of the Interior.
- Metropolitan water resources management at the Center for Urban Studies of the University of Chicago.
- Eastern United States water law at the College of Law of the University of Florida.
- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.
- Water resources economics at the Water Resources Research Institute of Rutgers University.
- Design and construction of hydraulic structures; weather modification; and evaporation control at the Bureau of Reclamation, Denver, Colorado.
- Eutrophication at the Water Resources Center of the University of Wisconsin, jointly sponsored by the EPA, Soap and Detergent Association, and the Agricultural Research Service.
- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.
- Water well construction technology at the National Water Well Association.

Supported by the Environmental Protection Agency in cooperation with WRSIC.

- Thermal pollution at the Department of Sanitary and Water Resources Engineering of Vanderbilt University.
- Textile wastes pollution at the School of Textiles of North Carolina State University.
- Water quality requirements for freshwater and marine organisms at the College of Fisheries of the University of Washington.
- Wastewater treatment and management at the Center for Research in Water Resources of the University of Texas.
- Agricultural livestock wastes at the Department of Agricultural Engineering of Iowa State University.

Subject Fields

- NATURE OF WATER
- WATER CYCLE
- WATER SUPPLY AUGMENTATION AND CONSERVATION
- WATER QUANTITY MANAGEMENT AND CONTROL
- WATER QUALITY MANAGEMENT AND PROTECTION
- WATER RESOURCES PLANNING
- RESOURCES DATA
- ENGINEERING WORKS
- MANPOWER, GRANTS, AND FACILITIES
- SCIENTIFIC AND TECHNICAL INFORMATION

INDEXES

- SUBJECT INDEX
- AUTHOR INDEX
- ORGANIZATIONAL INDEX
- ACCESSION NUMBER INDEX
- ABSTRACT SOURCES

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